

PROTECTING DELMARVA FOX SQUIRREL HABITAT  
FROM  
GYPSY MOTH AND SOUTHERN PINE BEETLE,  
BLACKWATER NATIONAL WILDLIFE REFUGE, 1994

Prepared by:

Rodney L. Whiteman  
and  
Bradley P. Onken

USDA Forest Service  
Forest Health Protection  
180 Canfield Street  
Morgantown, WV 26505

March 1994

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## **ACKNOWLEDGEMENTS**

The preparation of this report was certainly a team effort and we would like to acknowledge the contributions made by others on our staff. Karen Felton for the cover design; Jim Dobson for field work and data entry; and finally, Dave Breakey and Susan DeLost for producing the GIS maps. Their collective contributions are greatly appreciated.

## ABSTRACT

During the summer of 1992 and 1993, USDA Forest Service personnel conducted an inventory and analysis of the forested resources at Blackwater National Wildlife Refuge. The purpose of these activities was to provide site-specific information necessary to make management decisions regarding both the gypsy moth and southern pine beetle that currently threaten existing and potential habitat of the Delmarva Peninsula fox squirrel.

The results of this evaluation indicate that 34 stands, totaling 2796 acres, were rated as being good or fair fox squirrel habitat and have a moderate-high gypsy moth hazard rating. These stands should be monitored closely and treated when necessary. Southern pine beetle is less of a threat and will likely threaten only fair-rated fox squirrel stands that are near pure loblolly pine stands. Silvicultural management options are encouraged to both reduce the potential impact of the gypsy moth and southern pine beetle, and to improve the quality of Delmarva fox squirrel habitat.

## BACKGROUND

Blackwater National Wildlife Refuge is located in Dorchester County, Maryland approximately 10 miles south of Cambridge, Maryland (Figure 1). This 19,118 acre U.S. Fish and Wildlife Service facility is comprised of several creeks, rivers, swamps, marshes, agricultural fields, forested areas and contains several administrative buildings. The terrain at BNWR is practically flat with elevation ranging from sea level to 9 feet above sea level.

BNWR is home to several endangered species including the Delmarva Peninsula fox squirrel, *Sciurus niger cinereus*. In support of the Delmarva Peninsula Fox Squirrel Recovery Plan (1983), one of the management objectives for the Refuge is to preserve and enhance the Delmarva fox squirrel habitat.

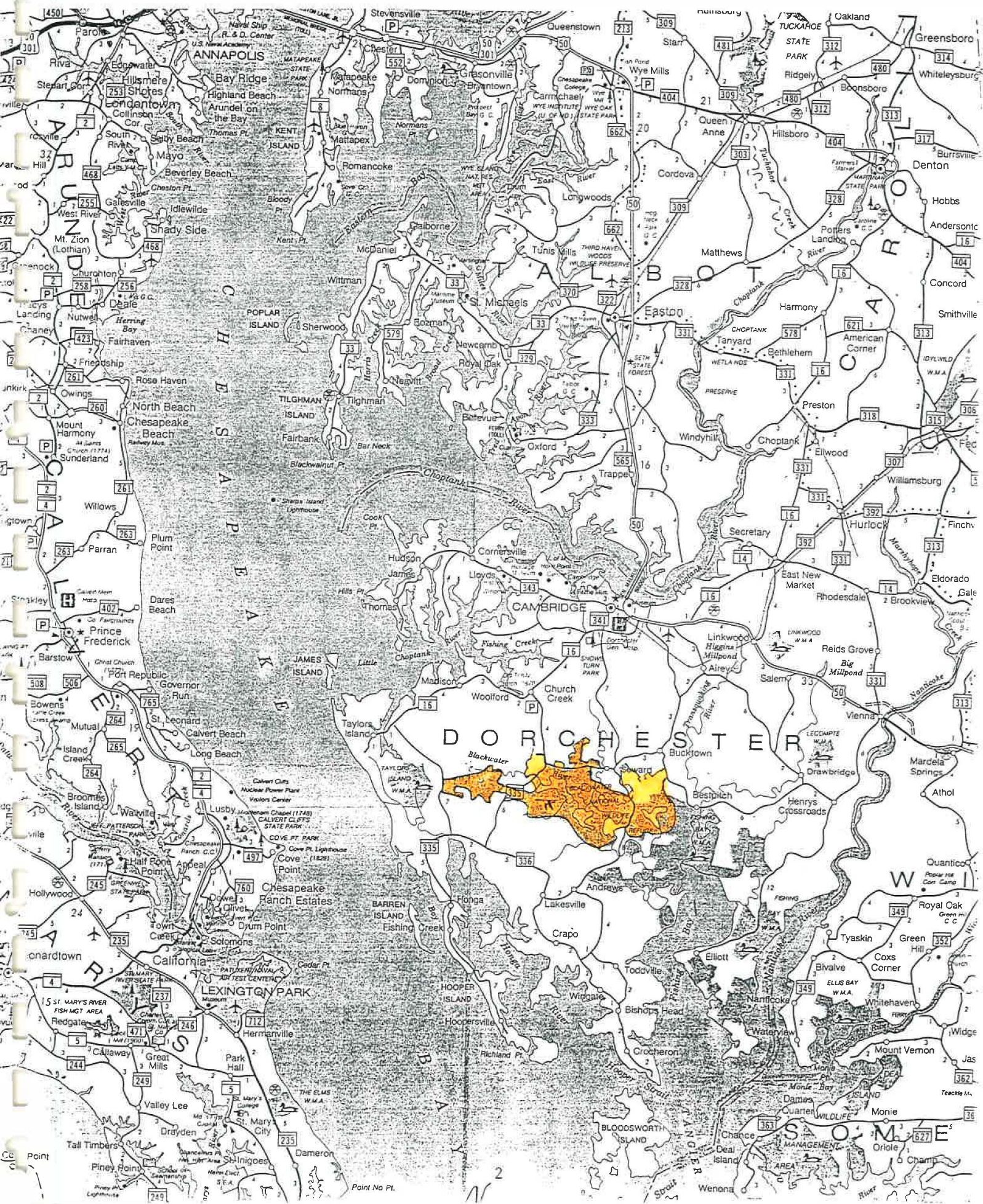
Like the gray squirrel, the fox squirrel feeds heavily on mast from oaks, hickory, beech, walnut and loblolly pine. Fox squirrels will also feed on agricultural crops such as corn or soybeans. Unlike the gray squirrel which does well in large forested tracts with a brushy understory, the fox squirrel prefers smaller, park-like forests that have sparse understory vegetation and are interspersed with agricultural fields.

The gypsy moth, *Lymantria dispar* (L.), and southern pine beetle, *Dendroctonus frontalis*, are two significant forest insect pests of the forests at BNWR. The focus of this project was to identify the areas where SPB and gypsy moth could have significant impacts on the habitat of the Delmarva fox squirrel and to recommend strategies to minimize their impacts. Gypsy moth populations first reached defoliating levels in 1992 when approximately 16 acres were defoliated. In 1993, defoliation increased to approximately 598 acres and it is likely to increase in the near future. Southern pine beetle (SPB) activity was also noted to be picking up in several areas on the refuge as well as on adjacent lands on the Eastern Shore. Although damage has been minimal thus far, conditions are considered favorable for a major outbreak in many areas on the refuge.

This report documents existing forest cover types found at BNWR and provides management recommendations and stand hazard rating for both gypsy moth and southern pine beetle. This report also includes a rating of desirable fox squirrel habitat and silvicultural recommendations to improve habitat conditions, using criteria outlined in the Delmarva Peninsula Fox Squirrel Recovery Plan.



Figure 1.-- Location of Blackwater National Wildlife Refuge.





## METHODS

Forested areas were mapped on 7 1/2 minute topographic maps using 1:6000 scale 9"x9" color infrared photography taken during the summer of 1990. These forested areas are shown in Figure 2. Forested stands were delineated through interpretation of the photography and fine-tuned during the cruise. By definition, a stand is a contiguous group of trees sufficiently uniform in species composition, arrangement of size classes and condition to be a homogeneous and distinguishable unit. Minor variations in species composition and or size class may occur in a stand. In most cases, stands smaller than 10 acres were not delineated from contiguous forested areas.

During the cruise, 10 basal area factor (BAF) prism plots were established in each stand using a square grid pattern, spaced 5-10 chains apart. The distance between the plots depended on the size and the shape of each individual stand. Information collected at each prism plot included species and diameter breast height (dbh) for all "in" trees. Also during the cruise, general observations were made in each stand regarding regeneration, soil moisture, sapling density and composition, potential mast production, stand maturity, and wildlife den trees.

There are several small, forested islands scattered throughout the marshes, swamps and rivers at BNWR. These small islands were not included in this forest inventory and analysis since they were inaccessible by foot. However, based on observations made from the aerial photography, these islands are primarily composed of loblolly pine.

### PLOT DATA COLLECTION

A total of 493 prism plots were established in the 65 stands during the cruise. Stand number, acres, basal area, average dbh, cover type, gypsy moth hazard rating, SPB hazard rating, species composition and field notes are given for each stand. The following is a brief description of each stand entry.

**Stand Number** - Stands were numbered in order which they were cruised.

**Acres** - Number of acres in the stand.

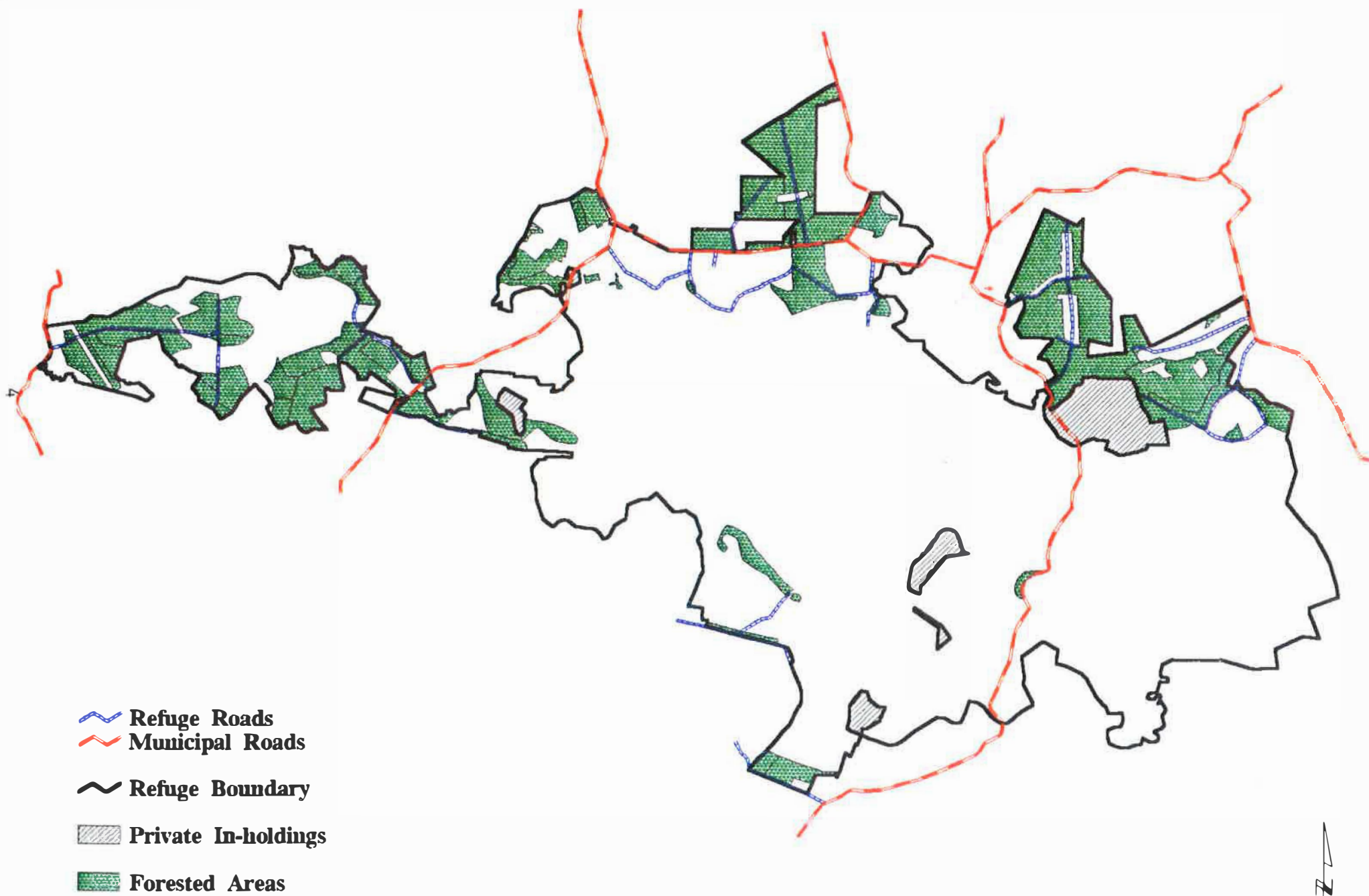
**Average DBH** - Average DBH is the summation of the dbhs from all the "in" trees of a stand divided by the total number of "in" trees.

**Basal Area** - Basal area is a term used to describe stand density. It is defined as the total cross-sectional area of the trees in a stand measured at dbh and is expressed in square feet per acre.

**Cover Type** - Cover Type is a descriptive classification of a stand based on present occupancy by tree species. The following classifications are used to describe the forest types surveyed. The forest cover types described by the Society of American Foresters were used as a guide, but modified somewhat to accommodate the description of forest types found at BNWR.

Loblolly Pine:	Loblolly pine accounts for 80 percent or more of the basal area in a stand.
Loblolly Pine-Oak:	Loblolly pine is the most common species and accounts for 20-79 percent of the basal area in a stand. Oak species account for 20 percent or more of the basal area.
Loblolly Pine-Hardwood:	Loblolly pine is the most common species and accounts for 20-79 percent of the basal area in the stand. Other hardwood species account for more basal area than oak species. Oak species account for less than 20 percent of the basal area.
Mixed Hardwood:	Various hardwood species account for 80 percent or more of the basal area in the stand.

**FIGURE 2. Forested areas at Blackwater National Wildlife Refuge.**



**Species Composition** - Species composition is listed for each stand in descending order of basal area occupied by each tree species. The number after each tree species is the percent of the stand's basal area that is accounted for by that species. Listed below is the common name, scientific name and acronym for each of the major tree species found at BNWR.

COMMON NAME	SCIENTIFIC NAME	ACRONYM
loblolly pine	<i>Pinus taeda</i>	LP
northern red oak	<i>Quercus rubra</i>	NRO
southern red oak	<i>Quercus falcata</i>	SRO
willow oak	<i>Quercus phellos</i>	WILLO
white oak	<i>Quercus alba</i>	WO
swamp chestnut oak	<i>Quercus michauxii</i>	SCO
pin oak	<i>Quercus palustris</i>	PO
red maple	<i>Acer rubrum</i>	RM
sweetgum	<i>Liquidambar styraciflua</i>	SG
blackgum	<i>Nyssa sylvatica</i>	BG
beech	<i>Fagus grandifolia</i>	BEE
holly	<i>Ilex opaco</i>	HOL
sassafras	<i>Sassafras albidum</i>	SASS
white ash	<i>Fraxinus americana</i>	WA
other non-commercial species	(no scientific name)	ONC

**Field Notes** - Field notes are general observations made about each stand during the cruise. These subjective observations were made on such things as regeneration, sapling composition, potential mast production, soil moisture, stand maturity, wildlife den trees, etc.

## HABITAT/HAZARD RATING

**Delmarva Fox Squirrel Habitat Rating** - Using the average dbh as a basis for stand maturity, and the percentage of basal area in hardwood mast producers (i.e. oak and beech), each stand was subjectively rated as good, fair, or poor with respect to the quality of fox squirrel habitat. Mature stands (average dbh > 12 inches) with at least 25 percent of basal area in mast producers were rated as good; immature stands with at least 25 percent of basal area in mast producers and any stand with 10-24 percent of the stand basal area in mast producers were rated as fair; and stands with less than 10 percent of the basal area in mast producers were rated as poor.

**Gypsy Moth Hazard Rating** - Gypsy moth hazard rating is a descriptive classification of a stand based on its likelihood of being attacked and damaged during a gypsy moth outbreak. Stands that contain a large percentage of tree species that are readily fed upon by gypsy moth larvae during all larvae stages will have a higher hazard rating than a stand that is comprised mostly of tree species that are not acceptable hosts. Susceptible tree species include apple, American basswood, bigtooth and quaking aspen, gray birch, white birch, larch, mountain-ash, sweetgum, willow and oak species (Mosher 1915). The gypsy moth hazard rating classifications used during this inventory and analysis along with their accompanying criteria are listed below and adapted from Herrick and Gansner (1986) and Gottschalk (1993).

Low:	Susceptible tree species account for 20 percent or less of the basal area in a stand.
Moderate:	Susceptible tree species account for 21-50 percent of the basal area in a stand.
High:	Susceptible tree species account for 51-80 percent of the basal area in a stand.
Very High:	Susceptible tree species account for 81 percent or more of the basal area in a stand.



**SPB Hazard Rating** - SPB hazard rating is a descriptive classification of a stand based on its likelihood of being attacked and damaged during a southern pine beetle outbreak. The classification system used was developed by Kushmaul et al. (1979) and then modified by Nebeker and Honea (1984). The rating considers pine basal area, total basal area, age, density and site index of the stand in determining its hazard class. Of these inputs, pine basal area and total basal area have the largest influence in determining a stand's hazard class. A stand that has a high pine basal area and a high overall basal area will be more susceptible and have a higher SPB rating than a stand that has a low pine basal area and a low overall basal area. The equation used to determine the SPB hazard ratings is as follows:

$$\text{Hazard Score} = 1.8342 (\text{pine basal area}) + 0.4085 (\text{total basal area}) + 0.705 (\text{age}) + 0.0002 (\text{stand density}) + 0.88 (\text{site index}) - 206.315$$

Hazard scores for each stand are then used to assign a hazard class based on the criteria listed below.

Very Low:	Hazard Score less than 11.
Low:	Hazard Score of 11-61.
Moderate:	Hazard Score of 62-167
High:	Hazard Score of 168-219.
Very High:	Hazard Score greater than 219.

## RESULTS

Individual stand results are presented in Appendix A. A summation of the combined stand results follows.

**Stand Number and Acres** - Sixty-five stands were cruised. Stand acreage ranges from 4 to 281 acres and averages 57.58 acres per stand. Over half of the stands were 40 acres or smaller while ten stands were larger than 100 acres. A forest cover type map is presented in Figure 3.

**Average DBH** - The average dbh for all stands ranged from 5.8 to 15.8 and averaged 10.6 inches. Twenty stands had an average dbh of 12 inches or greater while 45 stands averaged less than 12 inches.

**Basal Area** - Stand basal areas ranged from 80-190 and averaged 127 square feet per acre. Thirty-one stands, totaling 1272 acres, had a basal area of 130 square feet per acre or higher; 22 stands, totaling 1484 acres, had a basal area between 100-129 square feet per acre; and, twelve stands, totaling 870 acres, had a basal area less than 100 square feet per acre.

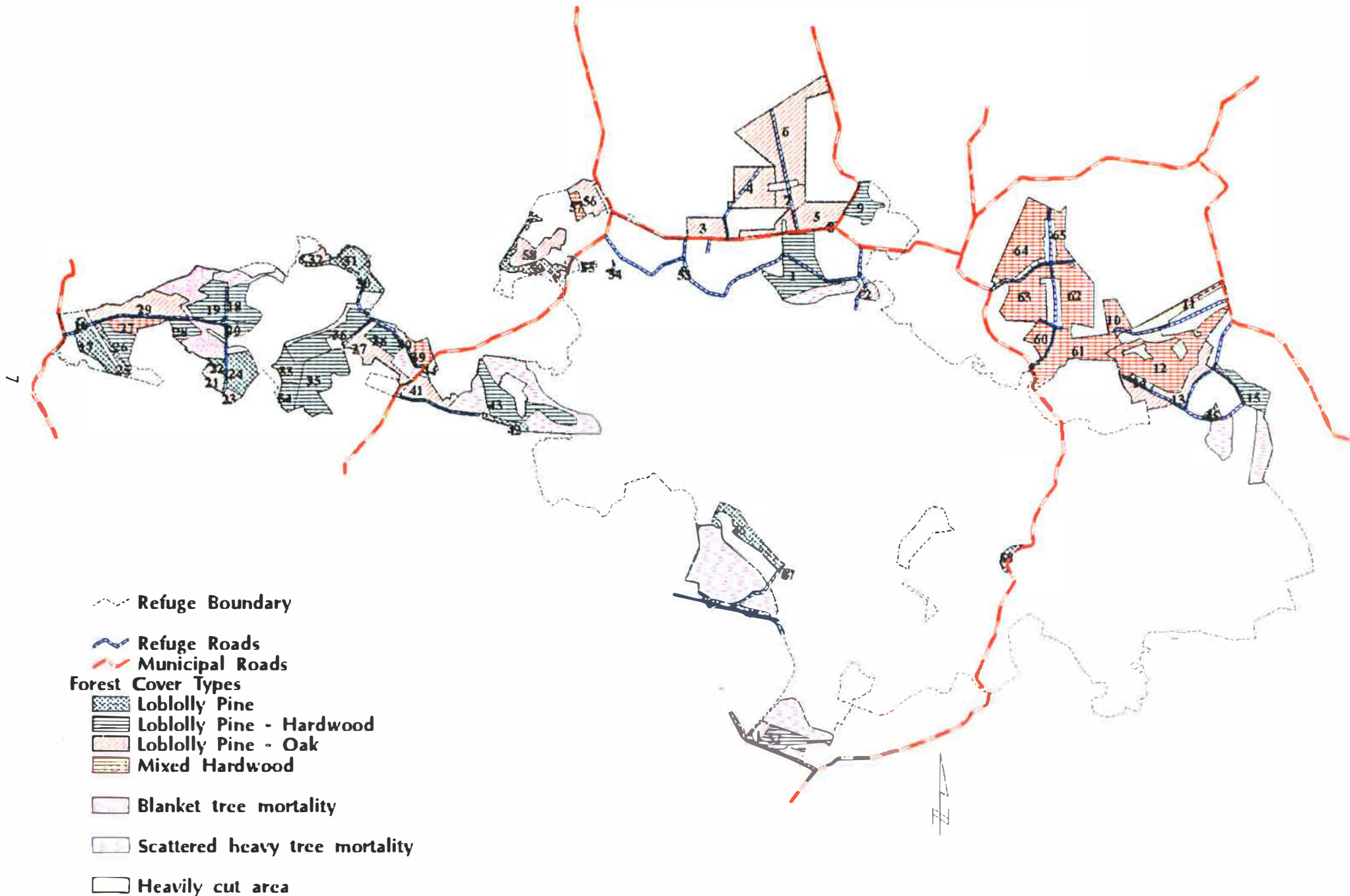
**Cover Type** - Loblolly pine is the most common forest cover type. Nineteen stands were classified as loblolly pine, 18 stands were classified as loblolly pine-oak, 16 stands were classified as loblolly pine-hardwoods and 12 stands were classified as mixed hardwoods (Figure 3). Loblolly pine-oak stands cover the largest area. Loblolly pine-oak accounts for 1144 acres, mixed hardwoods account for 1038 acres, loblolly pine-hardwoods accounts for 986 acres, and loblolly pine accounts for 458 acres.

In addition to the forest cover types, 994 acres were delineated to show areas of blanket tree mortality, scattered heavy tree mortality, or heavily cut areas. These areas are also shown in Figure 3.

Blanket tree mortality areas are areas in which 90 percent or more of the trees have died. These areas encompass 129 acres and were predominantly loblolly pine. All of these areas were noted to have been recently flooded and have standing water.

Scattered heavy tree mortality areas are areas in which 50 percent or more of the trees are dead and typically have a basal area of 40 or less. These scattered areas encompass 729 acres and mortality has occurred over long time. These areas were usually very wet and consisted primarily of loblolly pine. Most often, they bordered marshy or swampy areas.

**FIGURE 3. Forest Cover Types at Blackwater National Wildlife Refuge.**



**FIGURE 3A. Forest Cover Types at Blackwater National Wildlife Refuge.**

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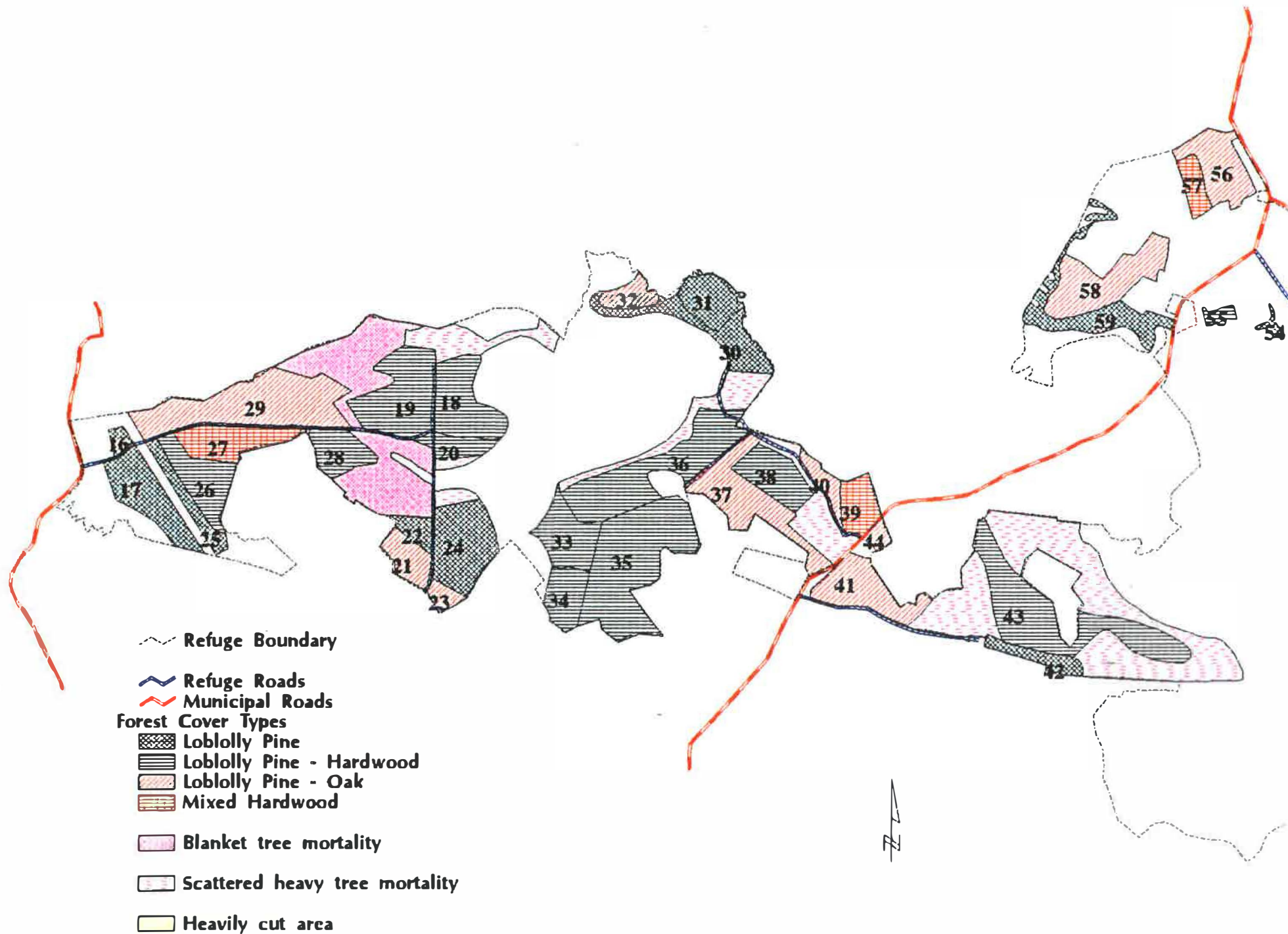
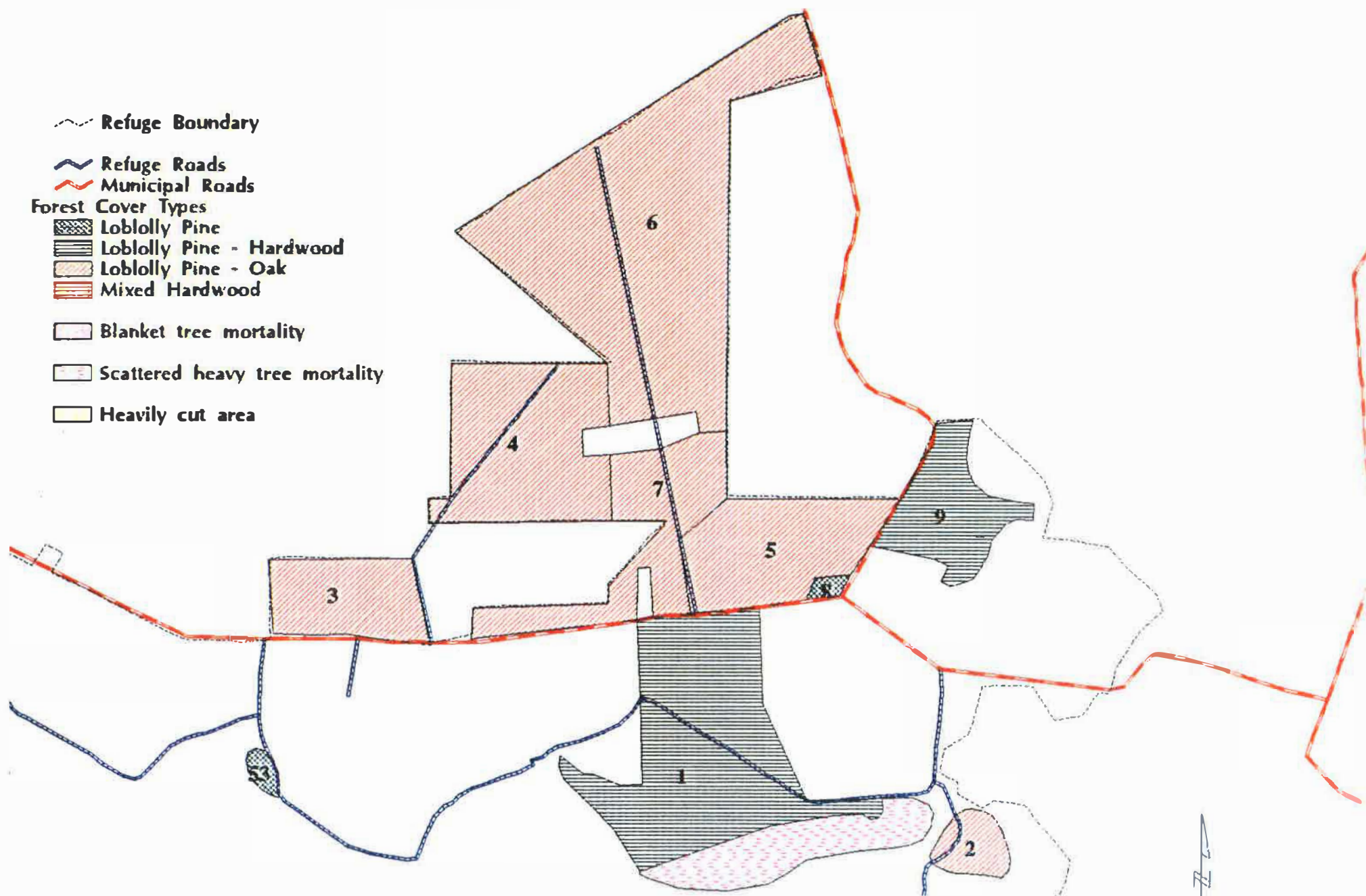




FIGURE 3B. Forest Cover Types at Blackwater National Wildlife Refuge.





**FIGURE 3C. Forest Cover Types at Blackwater National Wildlife Refuge.**

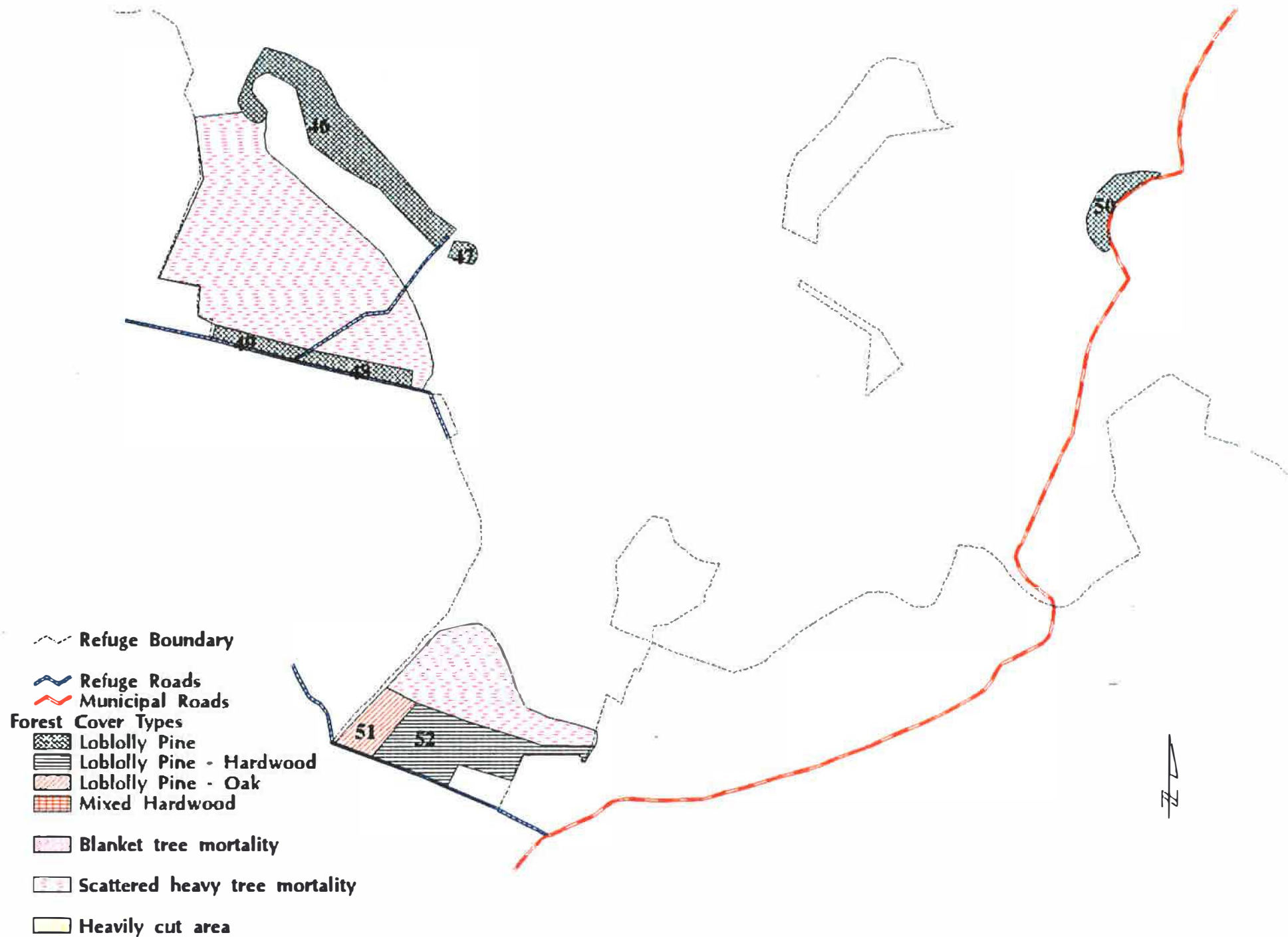
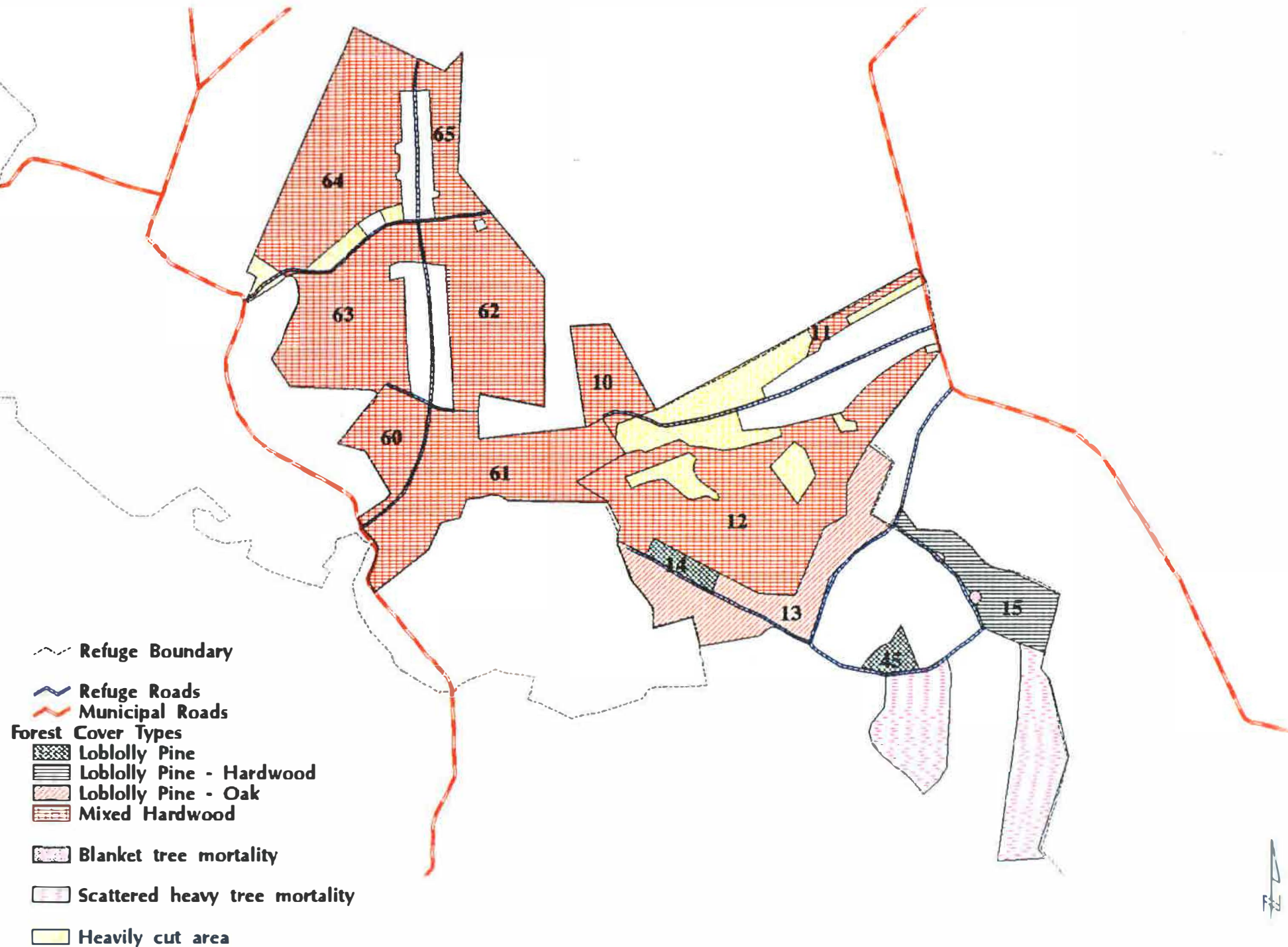


FIGURE 3D. Forest Cover Types at Blackwater National Wildlife Refuge.



Heavily cut areas are areas where trees were cut below a basal area of 50 square feet per acre. All the cut areas are located on the Longfield and Williams tracts and they encompass about 136 acres. Some of these areas include clear-cuts. Residual trees include some widely scattered mature oaks and regeneration is very dense.

**Species Composition** - Loblolly pine is the most dominant tree species at BNWR. In each of 19 stands, totaling 458 acres, it accounts for at least 80 percent of the basal area. In each of 33 other stands, totaling 2130 acres, it has the highest basal area of any species and accounts for 20-79 percent of the basal area. Other common overstory trees at BNWR include northern red oak, southern red oak, willow oak, white oak, swamp chestnut oak, red maple, sweetgum and beech. Other overstory trees that are found less frequently include pin oak, sassafras, white ash and miscellaneous non-commercial species. Common understory tree species include red maple, sweetgum, and blackgum and in some stands, holly.

**Field Notes** - Field notes are highly subjective and in most cases are hard to quantify. Remarks on soil moisture (i.e. the site was fairly dry, wet, very wet, etc.) may vary from season to season and year to year. A tree was called a den tree if it had a visible cavity and the tree may have been live or dead.

**Delmarva Fox Squirrel Habitat Rating** - Presented in Table 1 is the habitat rating for each stand. Eleven stands totaling 910 acres are rated as good, 29 stands totaling 1886 acres as fair, and 25 stands totaling 830 acres as poor fox squirrel habitat. Figure 6 illustrates the location of these stands.

**Gypsy Moth Hazard Rating** - Twenty-nine stands, covering 1038 acres were rated low, twenty-four stands totaling 1839 acres were rated as moderate, and twelve stands covering 749 were rated high. Table 1 and Figure 4 shows the gypsy moth hazard rating for each stand.

**SPB Hazard Rating** - Sixteen stands totaling 1227 acres have a SPB rating of very low, nine stands totaling 689 acres were rated low, twenty-seven stands encompassing 1243 acres were rated moderate, nine stands encompassing 396 acres were rated as high, and only four stands, covering 71 acres received a SPB rating of very high. Table 1 and Figure 5 show the SPB hazard rating for each stand.

Table 1.--Forest stand ratings for Delmarva fox squirrel habitat and risk ratings for gypsy moth and southern pine beetle infestations.

Stand Number	Fox Squirrel Habitat	Gypsy Moth Hazard Rating	Southern Pine Beetle Hazard Rating
1	Fair	Moderate	Moderate
2	Fair	Moderate	Moderate
3	Fair	Moderate	Moderate
4	Good	High	Low
5	Fair	Moderate	Very Low
6	Fair	Moderate	Low
7	Good	Moderate	Very Low
8	Poor	Low	Moderate
9	Fair	Low	Moderate
10	Good	High	Very Low
11	Good	High	Very Low
12	Good	High	Very Low
13	Good	Moderate	Moderate
14	Poor	Low	Moderate
15	Poor	Low	Moderate
16	Fair	Low	Moderate
17	Poor	Low	Moderate
18	Fair	Low	Moderate
19	Poor	Low	Moderate
20	Poor	Moderate	Moderate
21	Fair	High	Very Low
22	Poor	Low	Moderate
23	Fair	Moderate	Low
24	Poor	Low	High
25	Poor	Low	High
26	Fair	Low	High
27	Good	High	Very Low
28	Poor	Low	Moderate
29	Fair	Moderate	Low
30	Poor	Low	Moderate
31	Poor	Low	Very High
32	Fair	Moderate	Moderate
33	Fair	Moderate	Moderate
34	Poor	Moderate	High
35	Fair	Moderate	Moderate
36	Poor	Low	High
37	Fair	Moderate	Moderate
38	Fair	Moderate	Low
39	Fair	High	Very Low
40	Good	Moderate	Low
41	Fair	Moderate	Moderate
42	Poor	Low	Very High
43	Fair	Low	High
44	Good	High	Low
45	Poor	Low	Moderate
46	Poor	Low	Moderate
47	Poor	Low	Moderate
48	Poor	Low	Moderate



Stand Number	Fox Squirrel Habitat	Gypsy Moth Hazard Rating	Southern Pine Beetle Hazard Rating
49	Poor	Low	Moderate
50	Poor	Low	Very High
51	Fair	High	Very Low
52	Poor	Low	Moderate
53	Poor	Low	Very High
54	Fair	Low	High
55	Poor	Low	Moderate
56	Fair	Moderate	High
57	Fair	High	Very Low
58	Fair	High	Very Low
59	Poor	Low	High
60	Fair	Moderate	Very Low
61	Good	High	Very Low
62	Good	Moderate	Very Low
63	Fair	Moderate	Very Low
64	Fair	Moderate	Very Low
65	Fair	Moderate	Very Low

**FIGURE 4. Gypsy Moth Hazard Rating at Blackwater National Wildlife Refuge.**

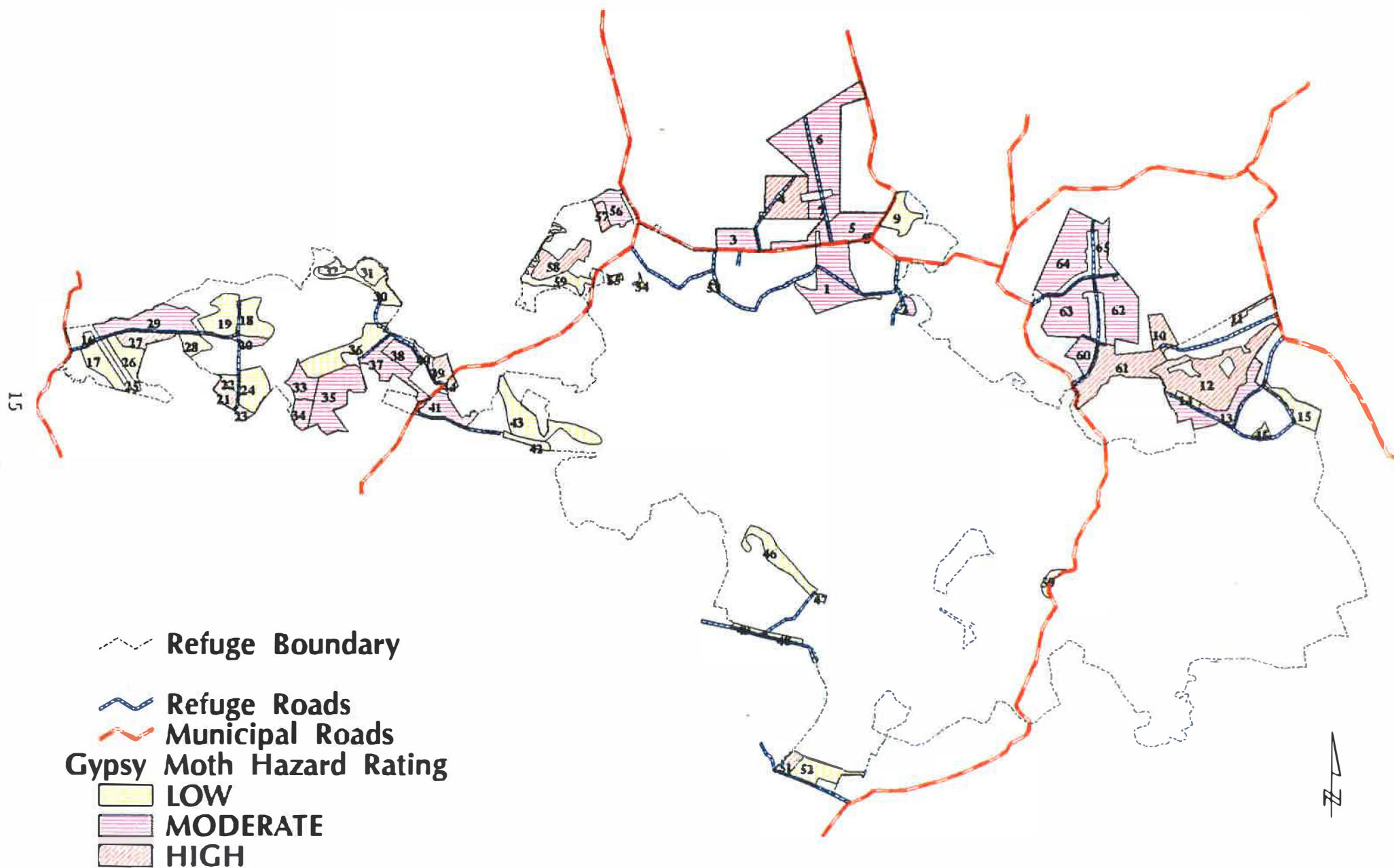


FIGURE 4A. Gypsy Moth Hazard Rating at Blackwater National Wildlife Refuge.

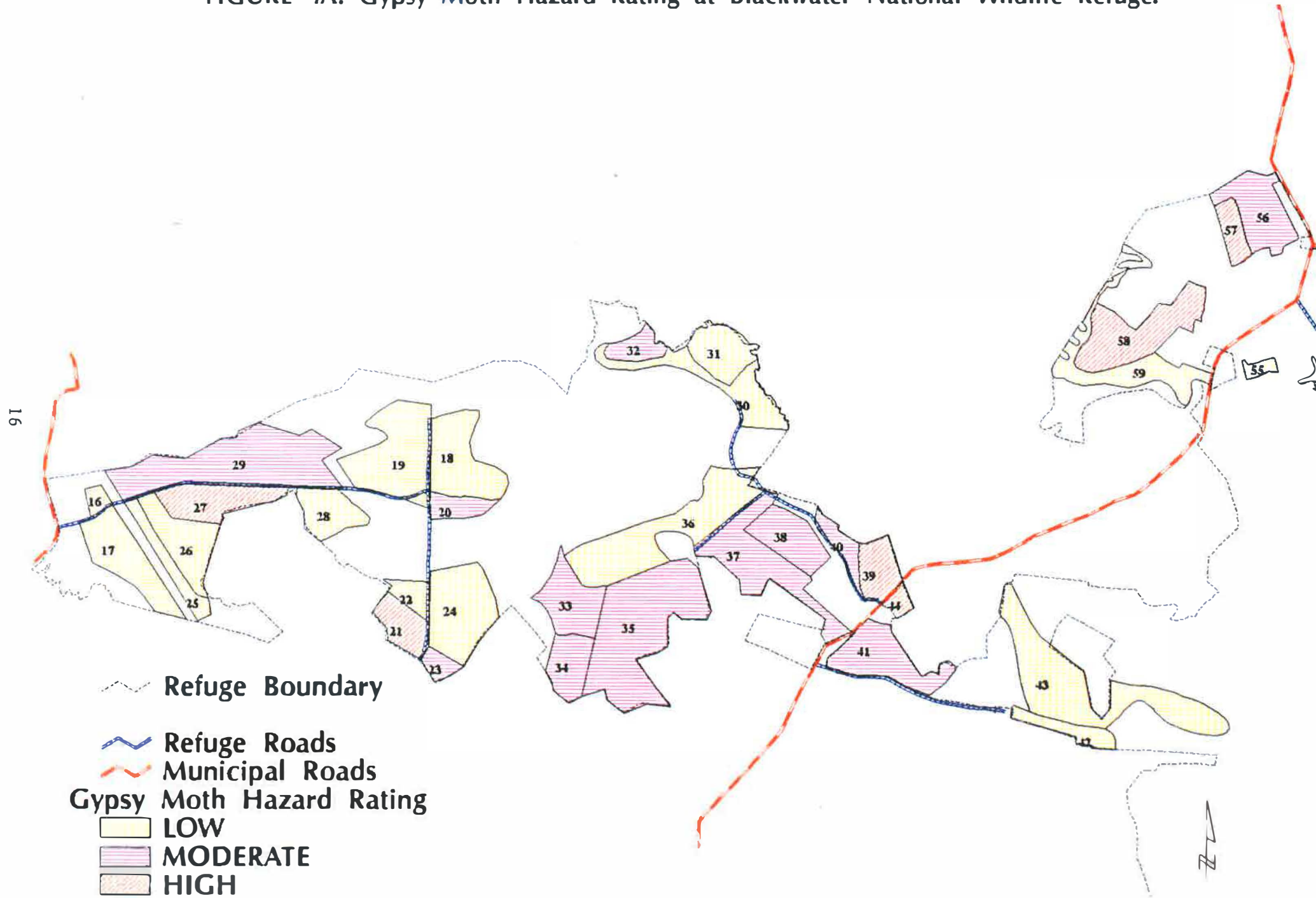


FIGURE 4B. Gypsy Moth Hazard Rating at Blackwater National Wildlife Refuge.

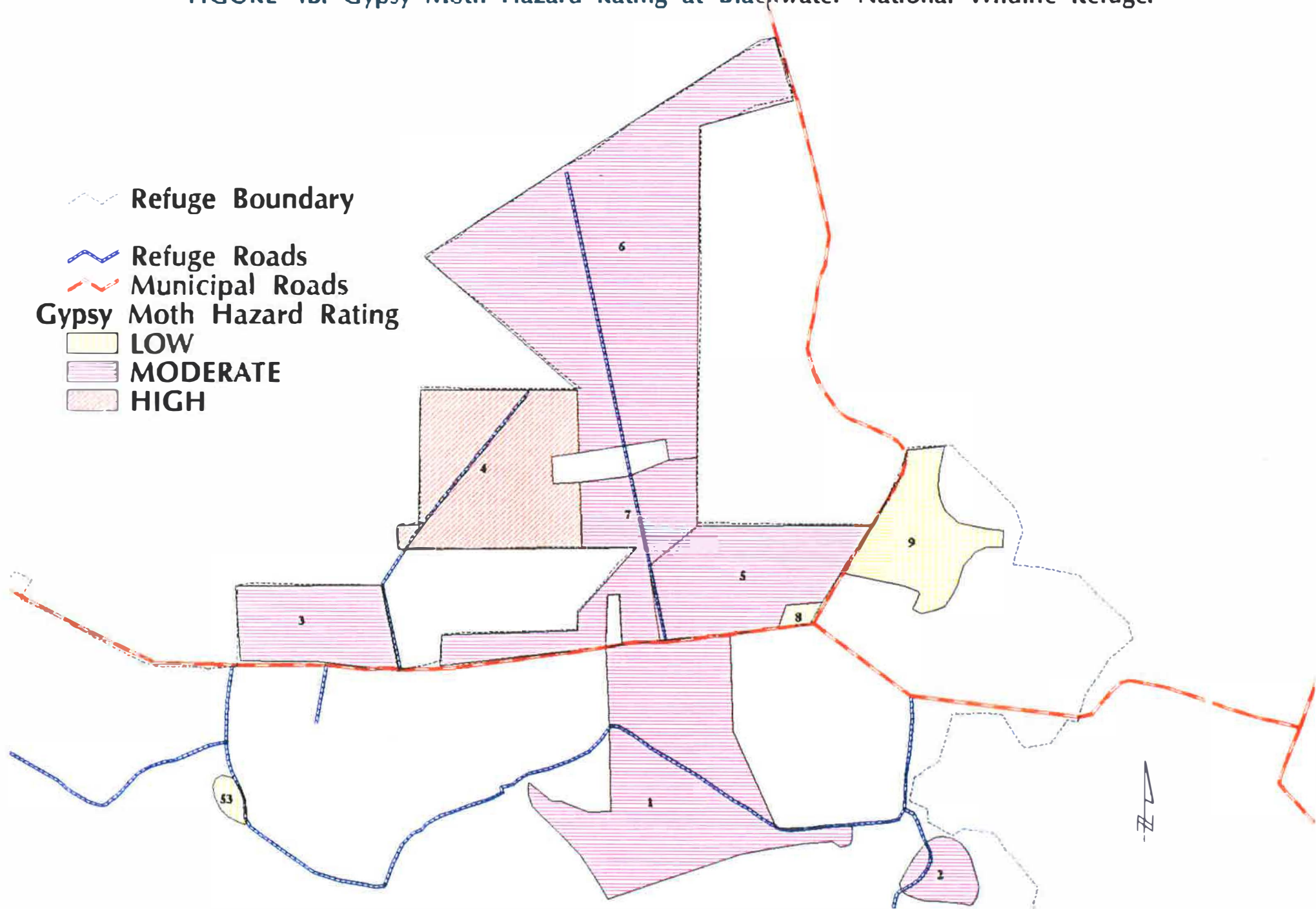




FIGURE 4C. Gypsy Moth Hazard Rating at Blackwater National Wildlife Refuge.

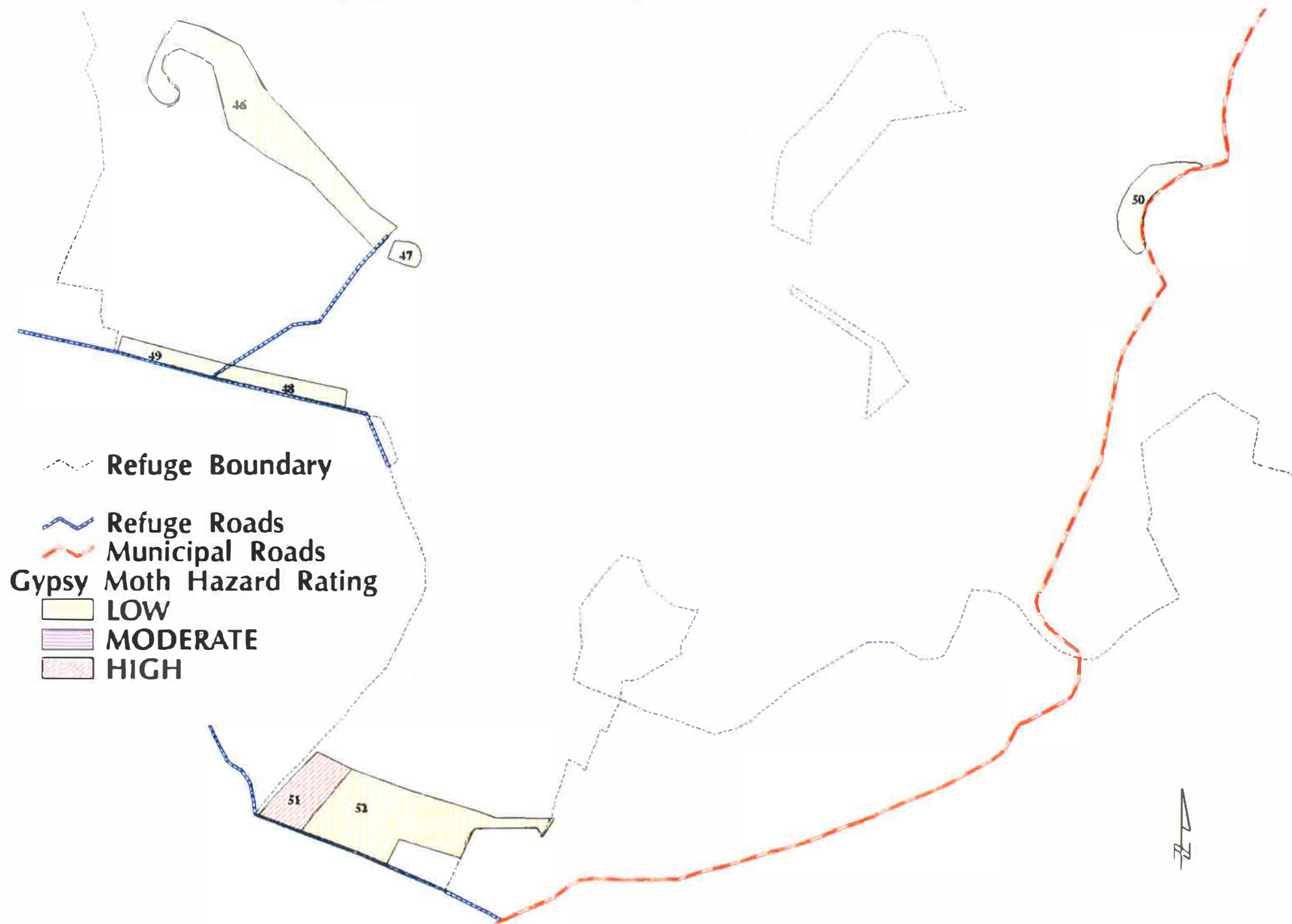
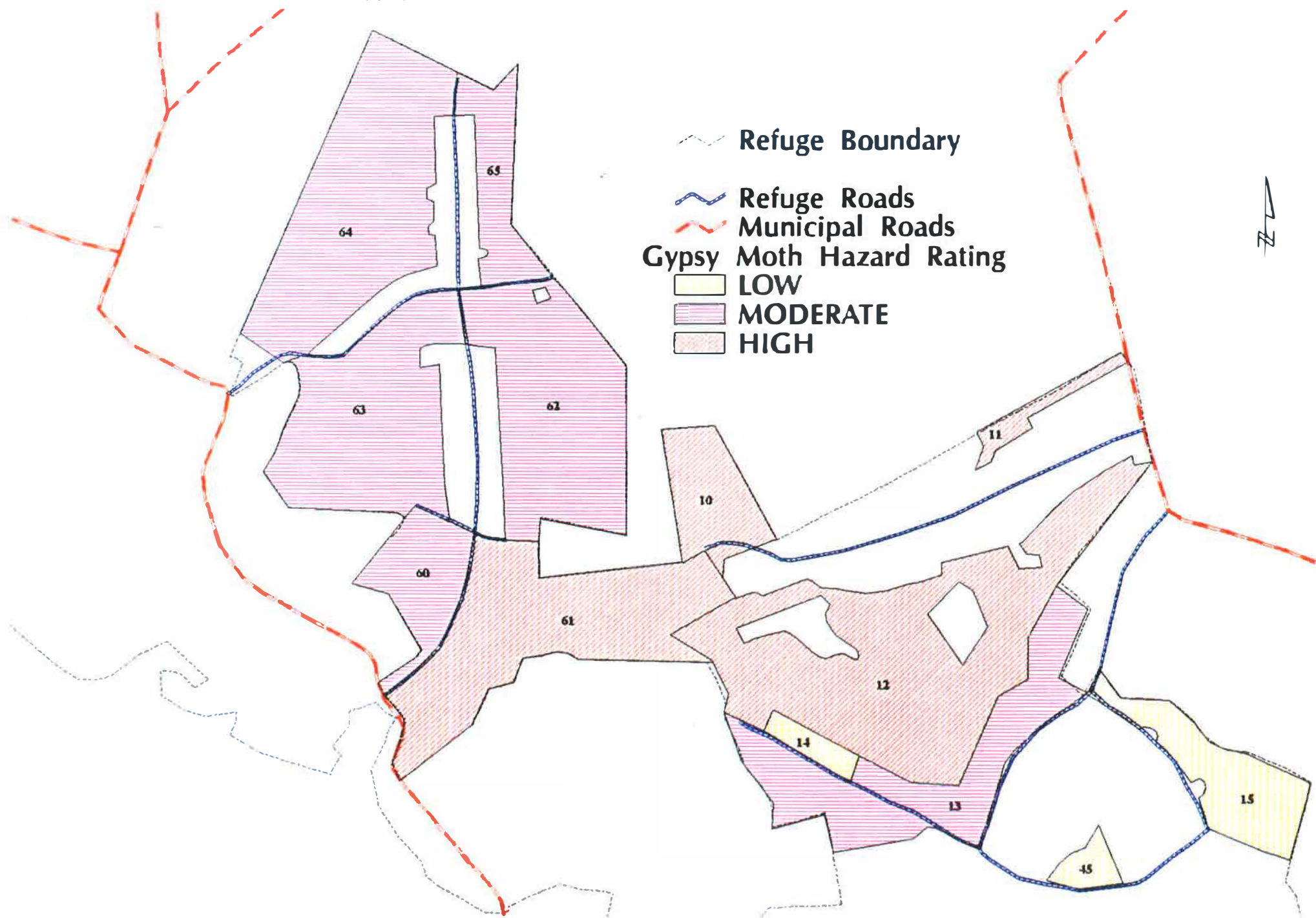


FIGURE 4D. Gypsy Moth Hazard Rating at Blackwater National Wildlife Refuge.

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## DISCUSSION

To help prioritize gypsy moth and SPB management activities, each stand was evaluated as to the existing and potential quality of fox squirrel habitat. Table 1 compares each stand's habitat rating and hazard rating for both gypsy moth and SPB. As stated previously, the ideal habitat for the Delmarva fox squirrel is considered to be a forested area which includes an open understory, an abundance of mast, adequate denning sites and in proximity to agricultural crops such as corn or soybeans. Even though loblolly pine seeds are eaten by Delmarva fox squirrels, Allen (1943) found that hardwood mast makes up 70 percent of the diet of fox squirrels. Hardwood mast at BNWR comes primarily from beech and several species of oaks. Since loblolly pine is a significant component of the overstory in many of the stands, does provide shade and helps to maintain a sparse understory.

Enhancing fox squirrel habitat can be accomplished to a large degree through silviculture. To maximize hardwood mast production and maintain sparse understory vegetation, one should promote large crown development of mature mast producers in the overstory. Mast production in immature stands (average dbh < 12 inches) is likely to be very limited. Although these stands can have an open understory, they typically are overcrowded and as a result have smaller crowns. A 12 inch dbh tree will generally produce 225 percent more mast than it did when it had a 10 inch dbh (Downs and McQuilkin, 1944). Generally, mast production increases with diameter of the tree until it reaches 22-24 inches dbh, at which time mast production starts to decline as the tree becomes overmature.

In immature pole size stands, the process of reaching the desired stand conditions can be expedited in most cases by identifying potential hard mast crop trees and by conducting a light thinning around these trees to encourage crown development. All other things being equal, mast production is far greater and more likely to occur from large crowned trees than smaller crowned trees (Burns, et al., 1954). In mature stands that do not meet the desired stand conditions, a more intense stand examination would be required prior to making any stand prescription. Nevertheless, simple forest management practices can enhance both the quality and quantity of the existing fox squirrel habitat at BNWR. Efforts towards crop tree selection in all cases should be focused on healthy trees with well-formed crowns and should include species from both the red and white oak groups along with beech. This crop tree species diversity will promote a more consistent mast crop.

During any silvicultural treatment, neither den trees nor adjacent trees should be cut. The foliage of the adjacent trees shades the bole of the den tree, thus keeping the den cooler. In order to promote additional den sites, trees interfering with crop tree crown development should not be felled, but rather left standing and killed by girdling or by using systemic herbicides.

Eleven stands rated as good fox squirrel habitat also have either moderate or high gypsy moth hazard rating and should receive the highest priority for treatment when gypsy moth populations reach defoliating levels. These stands have a large number of mast producers, with the majority of them being oaks. Oaks are excellent mast producers but they are highly susceptible to gypsy moth. Stands that were rated as fair fox squirrel habitat and a moderate-high gypsy moth hazard rating (23 stands) should receive the next highest treatment priority while the least priority should be given to stands rated as poor fox squirrel habitat and/or have a low gypsy moth hazard rating (31 stands).

Overall, the threat of a SPB outbreak in stands containing good fox squirrel habitat is small. SPB poses less of a threat to the Delmarva fox squirrel than the gypsy moth because the squirrel is less dependent on the pine than the oaks. Stand 13 was the only stand rated as good fox squirrel habitat that had an SPB hazard rating higher than "low". By far the largest risk is in the "fair" habitat stands. Should an outbreak occur in these stands, the outcome may be somewhat of a trade-off. The mortality in loblolly pine could favor an increase in hardwood species (including hard-mast producers) but it will also open up the canopy and allow growth in the understory--at least until the canopy can successfully close again. Because these are mixed hardwood/pine stands, the likelihood of a spot infestation originating within them is less than in pure pine stands (Showalter and Turchin, 1993). Therefore, efforts to curb any build-up of SPB in these stands would best be directed at adjacent pure pine stands.

FIGURE 5. Southern pine beetle hazard rating at Blackwater National Wildlife Refuge.

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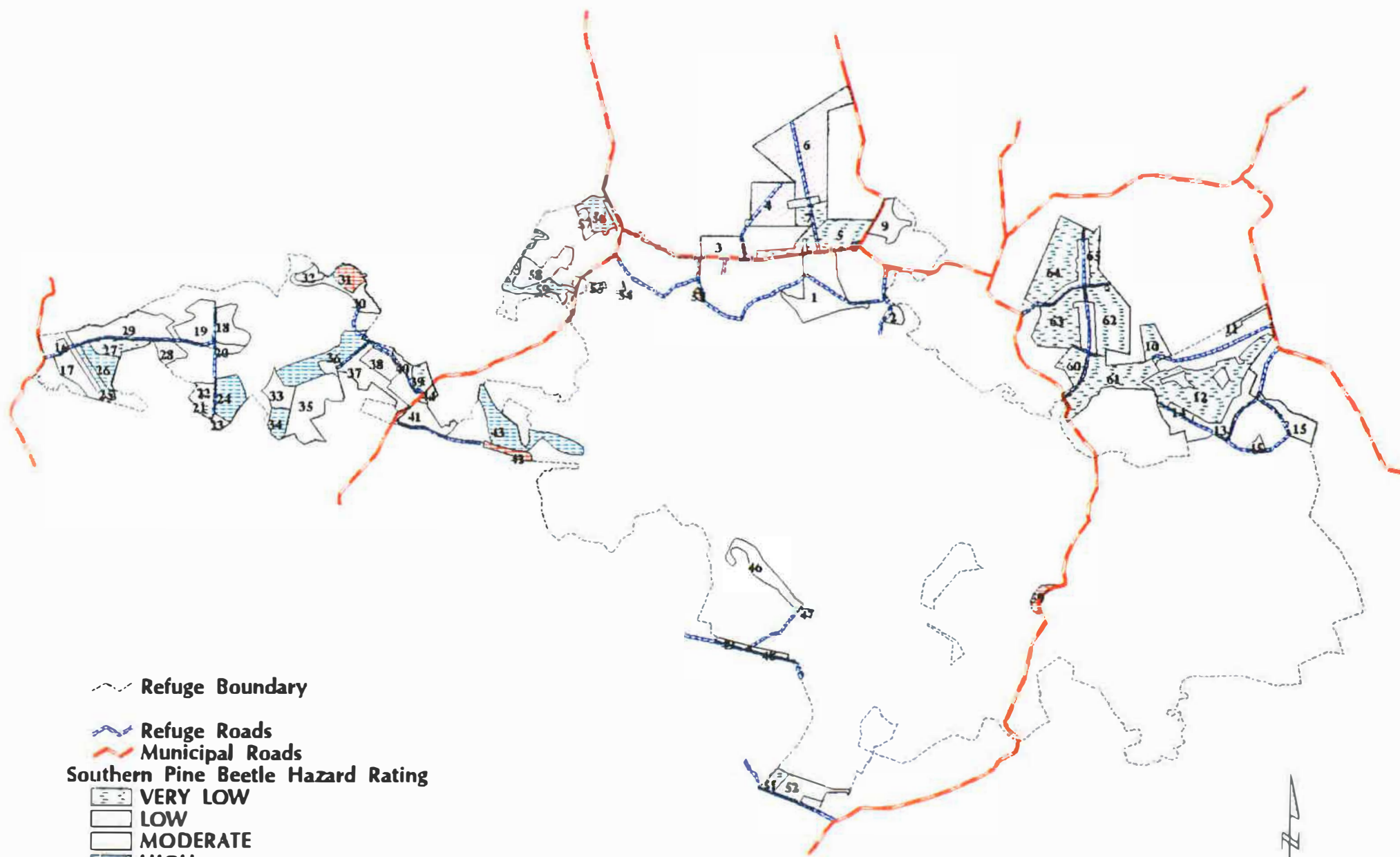
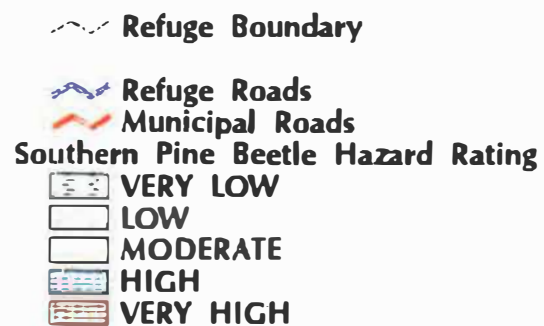




FIGURE 5A. Southern Pine Beetle Hazard Rating at Blackwater National Wildlife Refuge.

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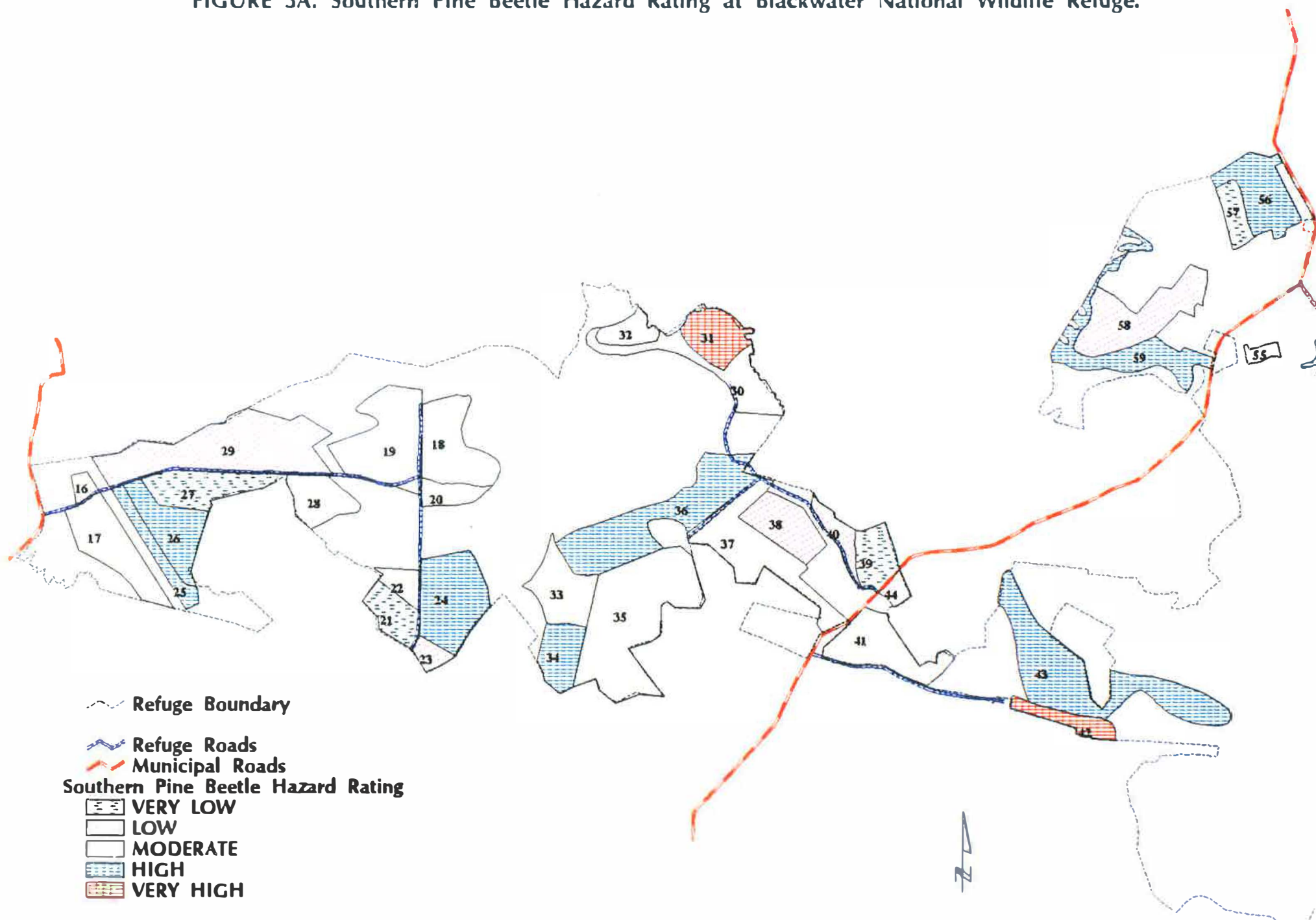


FIGURE 5B. Southern Pine Beetle Hazard Rating at Blackwater National Wildlife Refuge.

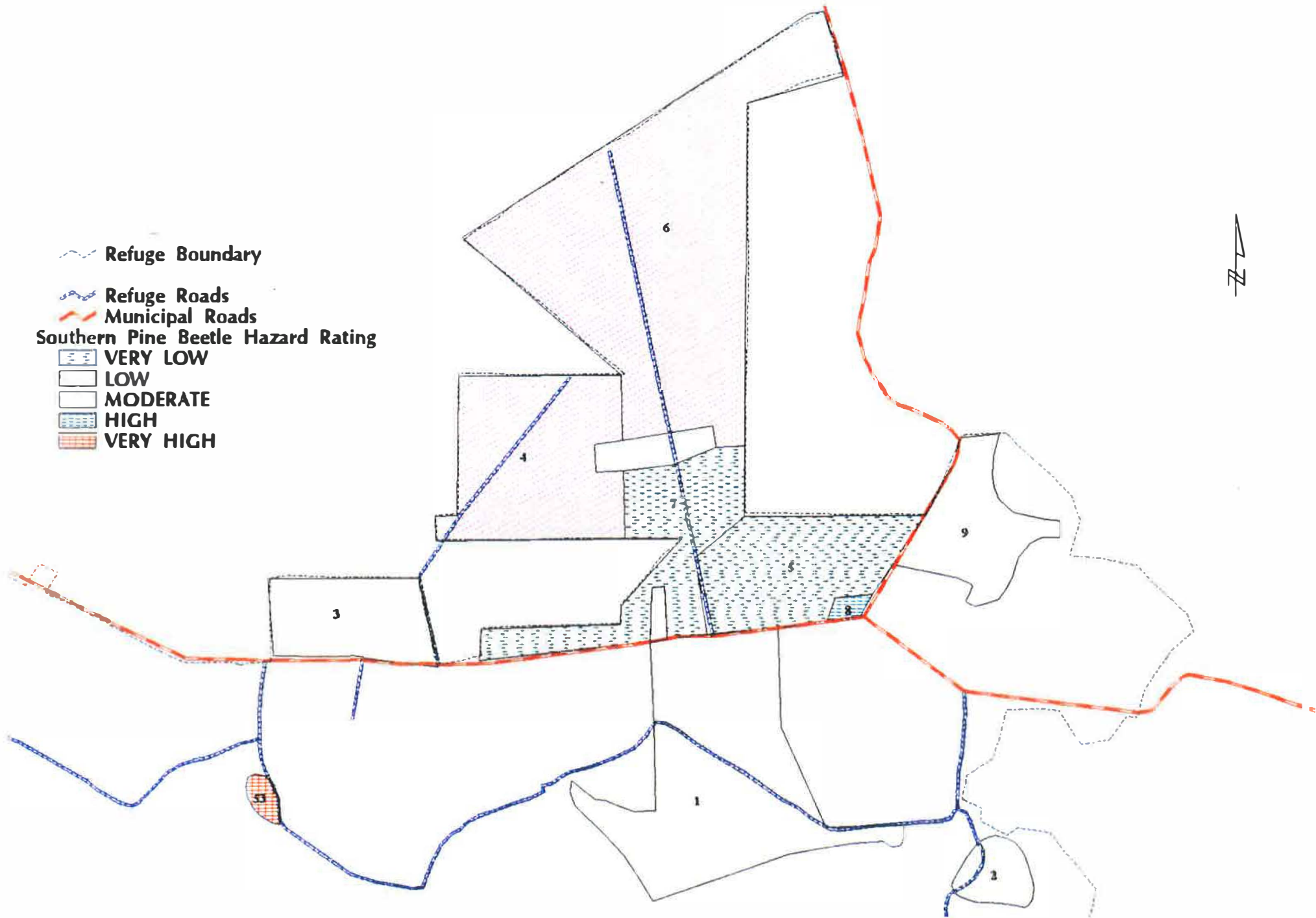


FIGURE 5C. Southern Pine Beetle Hazard Rating at Blackwater National Wildlife Refuge.

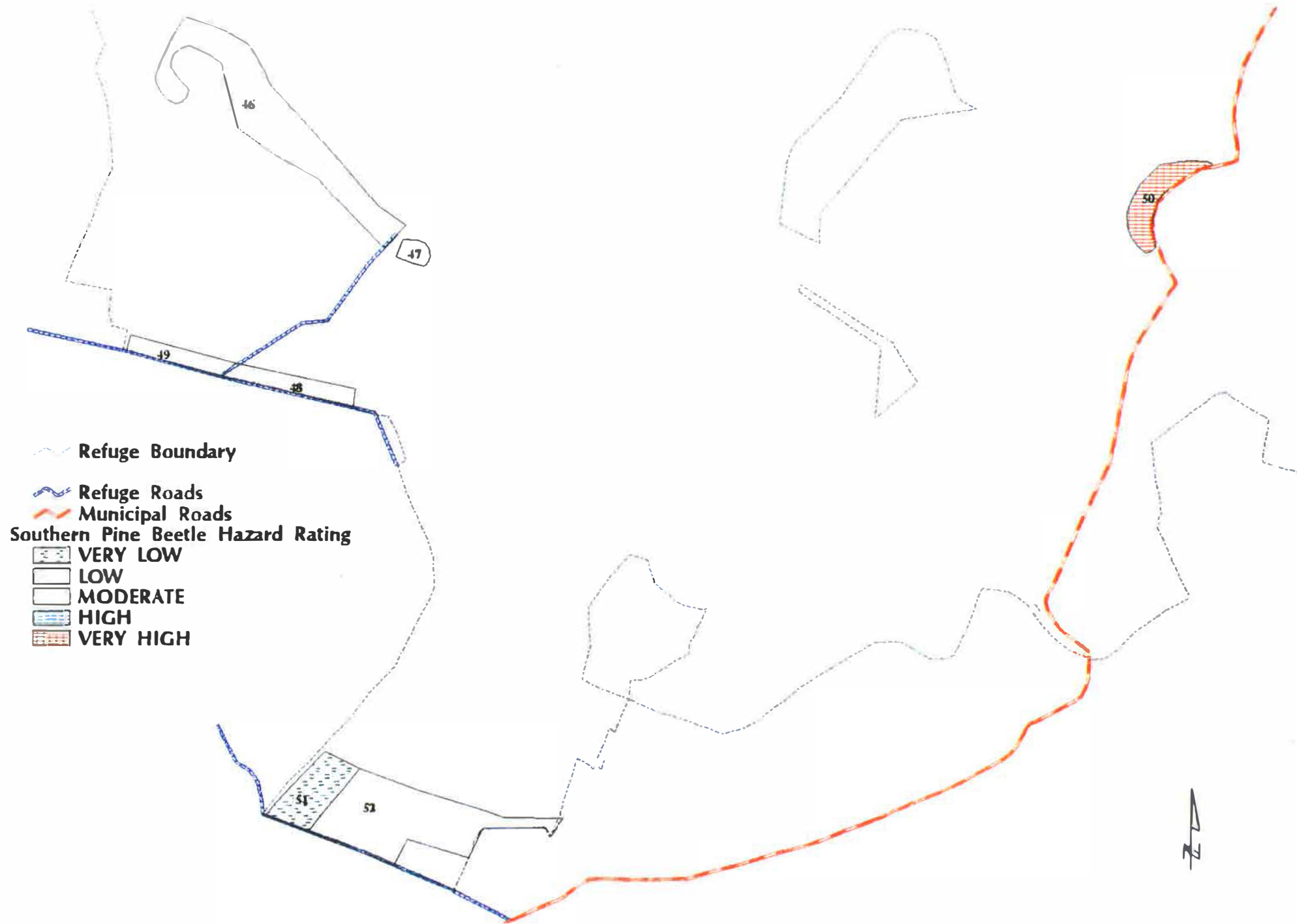
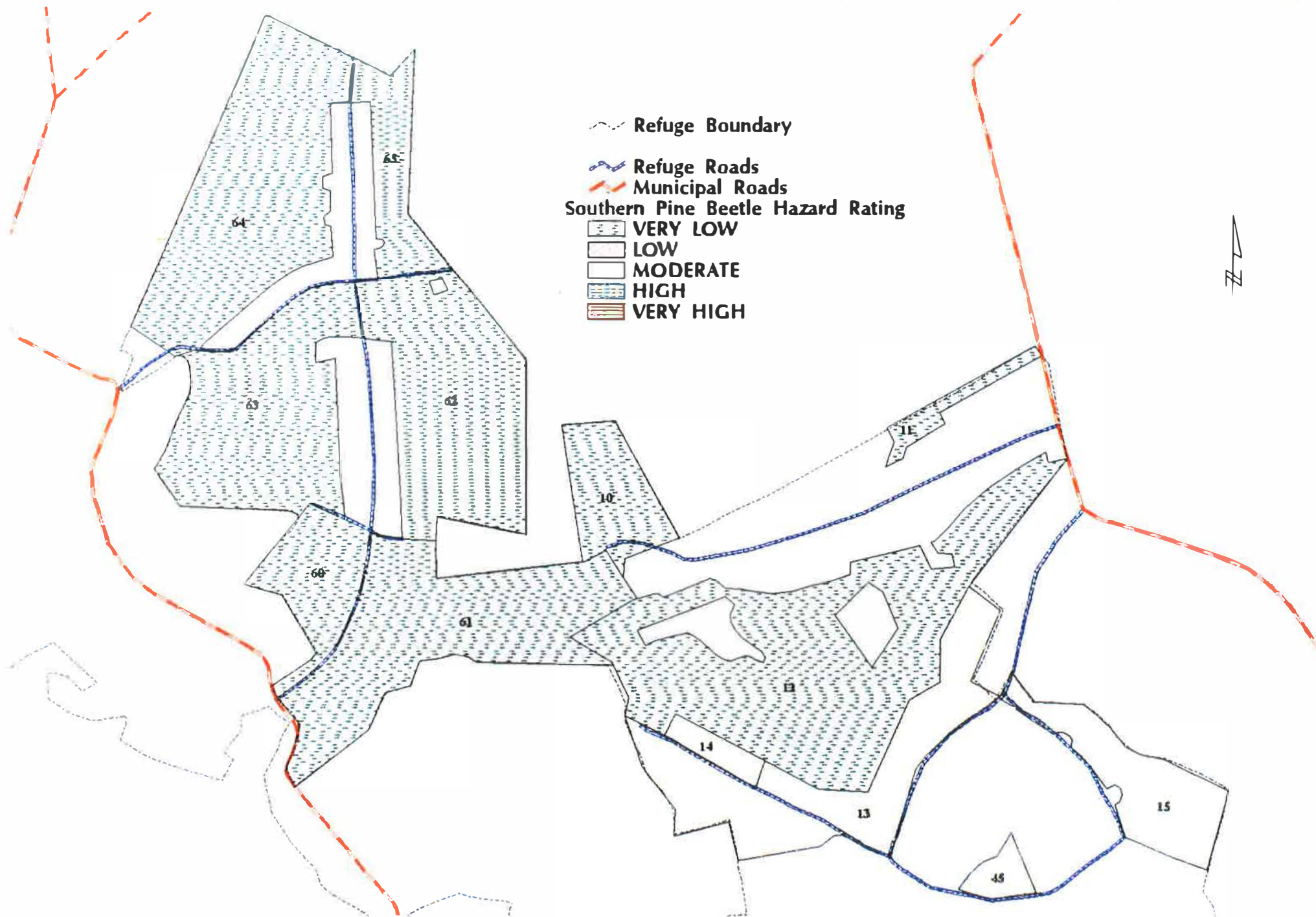




FIGURE 5D. Southern Pine Beetle Hazard Rating at Blackwater National Wildlife Refuge.





## RECOMMENDATIONS

### Gypsy Moth

Gypsy moth populations should be closely monitored in all stands rated as having a moderate to high risk of becoming infested. When necessary, pesticide treatments should be conducted in stands rated as fair or good fox squirrel habitat. Silvicultural treatments could be used effectively to manage and improve fox squirrel habitat by increasing mast production and by reducing the chance of mortality of good or potentially good mast producing trees. Silvicultural treatments should be implemented in stands rated as fair or good fox squirrel habitat (Figure 6).

Each stand should receive further analysis prior to implementing a stand prescription. In general however, a light selective thinning around mast producing crop trees to stimulate crown development and improve the tree vigor of selected crop trees is recommended. As many as 25-30 potential crop trees per acre should be identified, marked and then receive a 3-4 side release from competing trees. To avoid opening up the stand and risk excessive understory development, no more than 10-15 trees per acre should be released in any one treatment. A follow-up thinning to release the remaining crop trees should be made once the canopy has successfully closed again. Stands rated as fair fox squirrel habitat and having greater than 130 square feet of basal area per acre should be targeted first as they probably would provide the greatest gain through these habitat improvement efforts. Typically, basal area in a mature, fully stocked stand ranges from 100 to 130 square feet per acre. When the basal area in a stand is high (greater than 130 square feet per acre), stress from the competition for sunlight, water, nutrients, etc. is also high. As such, the overall growth rate of the stand is lower, some non-dominant trees will die and overall mast production is significantly reduced. Stressed trees attacked by other agents such as gypsy moth or SPB are even more heavily impacted and less likely to survive. To ensure a relatively closed canopy and avoid stimulating unwanted vegetative growth in the understory, the residual stand's basal area should not be thinned below 80 square feet per acre.

### SPB

Monitor SPB activity in stands with a high pine component and are adjacent to good and fair-rated fox squirrel habitat. Prevent SPB spread by eliminating spot infestations. Silvicultural treatments to reduce the risk of SPB outbreak in adjacent pine stands is also recommended. This treatment would consist of a thin to reduce the number of stressed and overmature trees and promote a healthier, more resistant residual.

The preferred method of controlling an SPB outbreak is to cut and remove the infested trees and non-infested pine trees bordering the infested area. The rule of thumb is to remove all pines within 1.5 times the height of the trees around the infestation. Moser et. al (1987) suggests that removal of green trees is as important as removing infested trees to prevent the establishment of brood trees. Removal is not practical, felling the infested pines so that they lay horizontally on the ground is the best choice of SPB management. Although an SPB attack on downed timber can occur, it's greater than on standing trees. These practices should be considered for both prevention and treatment of currently infested areas. The residual basal area in thinning high risk stands should not be less than 80 square feet per acre or should more than 35 percent of the total basal area be removed. To prevent windthrow damage and other stress factors associated with excessive thinning, stands should receive a complete stand analysis prior to implementing a cutting prescription.

FIGURE 6. Fox Squirrel Habitat at Blackwater National Wildlife Refuge.

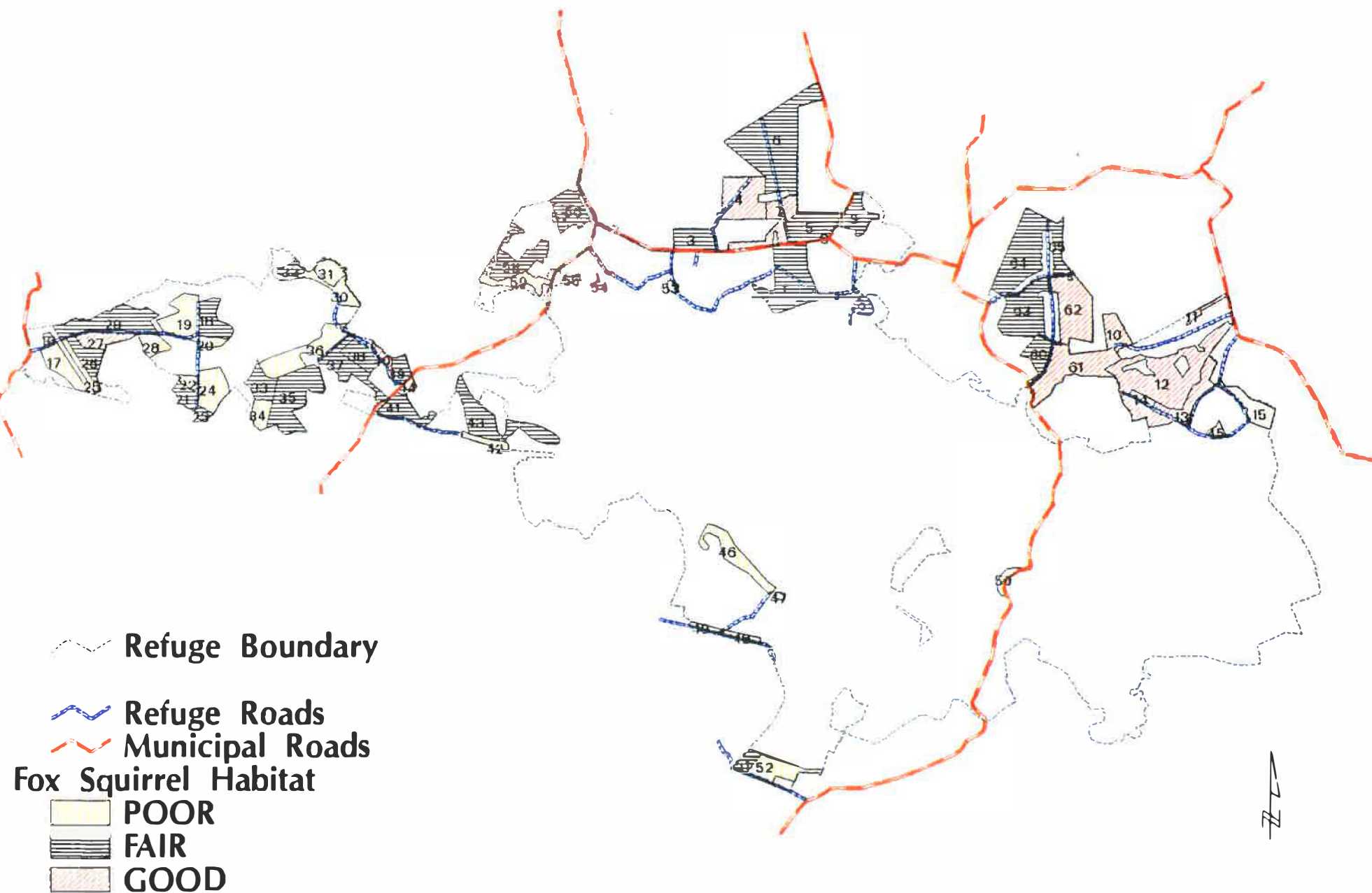


FIGURE 6A. Fox Squirrel Habitat at Blackwater National Wildlife Refuge.

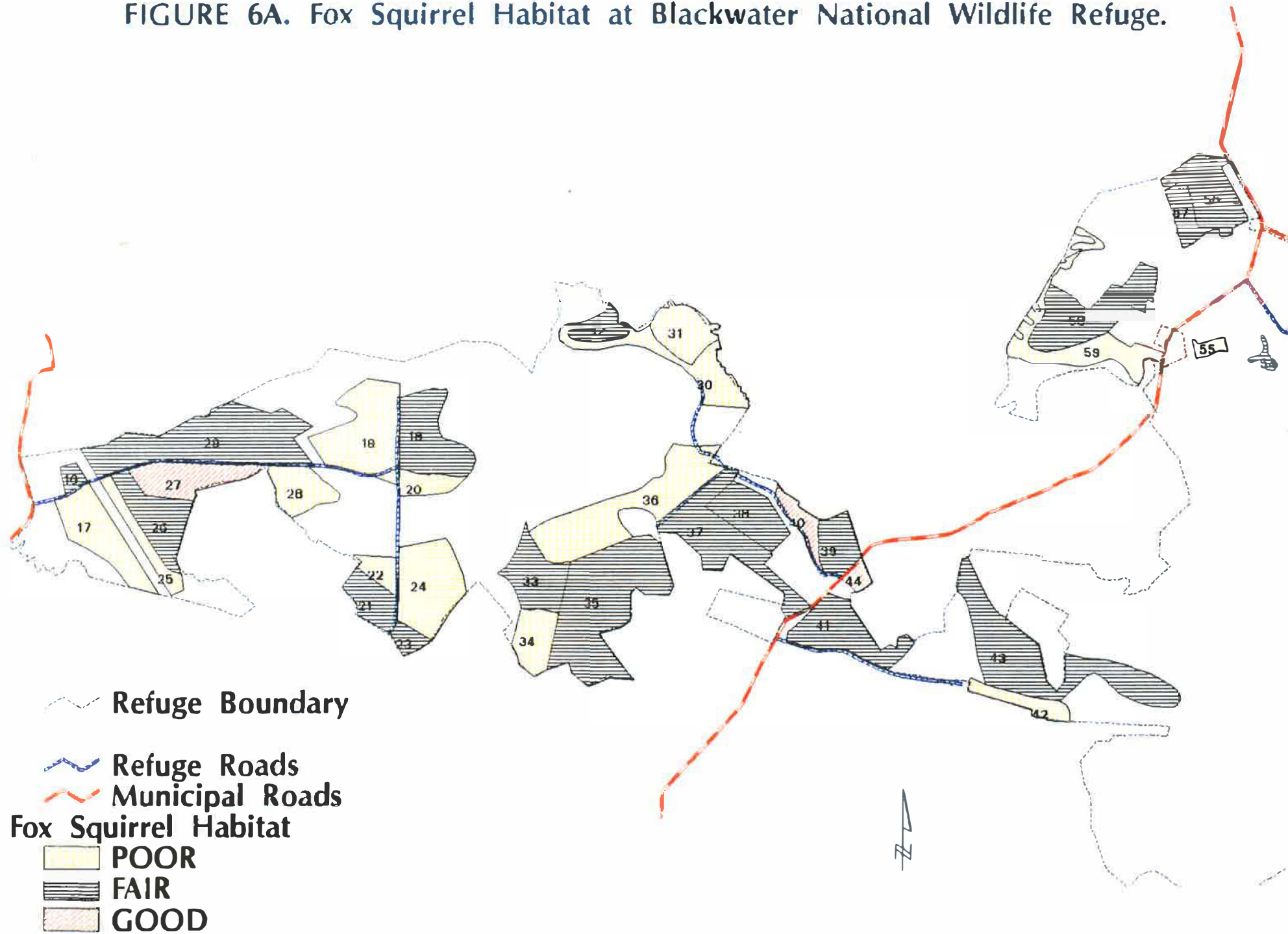


FIGURE 6B. Fox Squirrel Habitat at Blackwater National Wildlife Refuge.

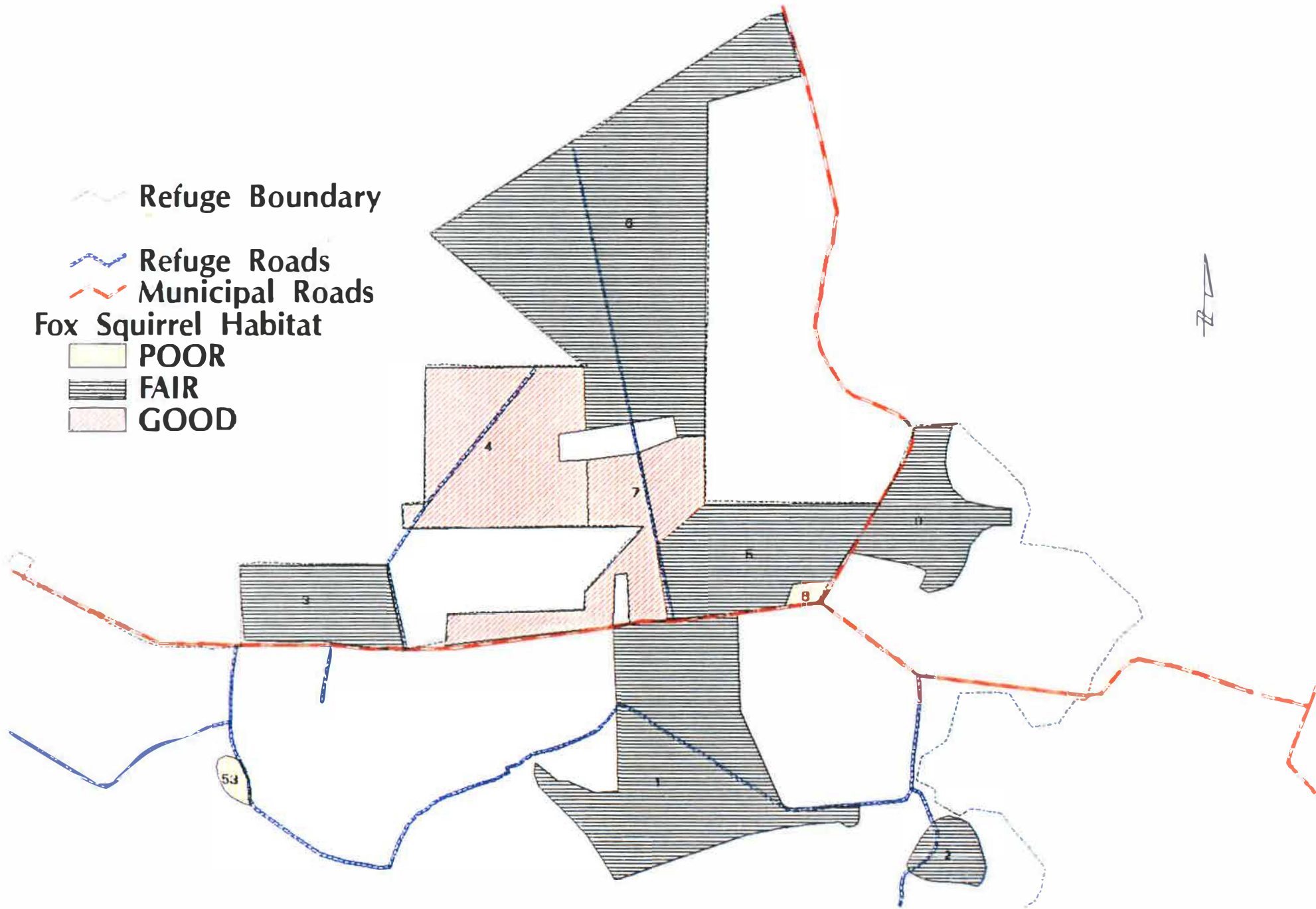




FIGURE 6C. Fox Squirrel Habitat at Blackwater National Wildlife Refuge.

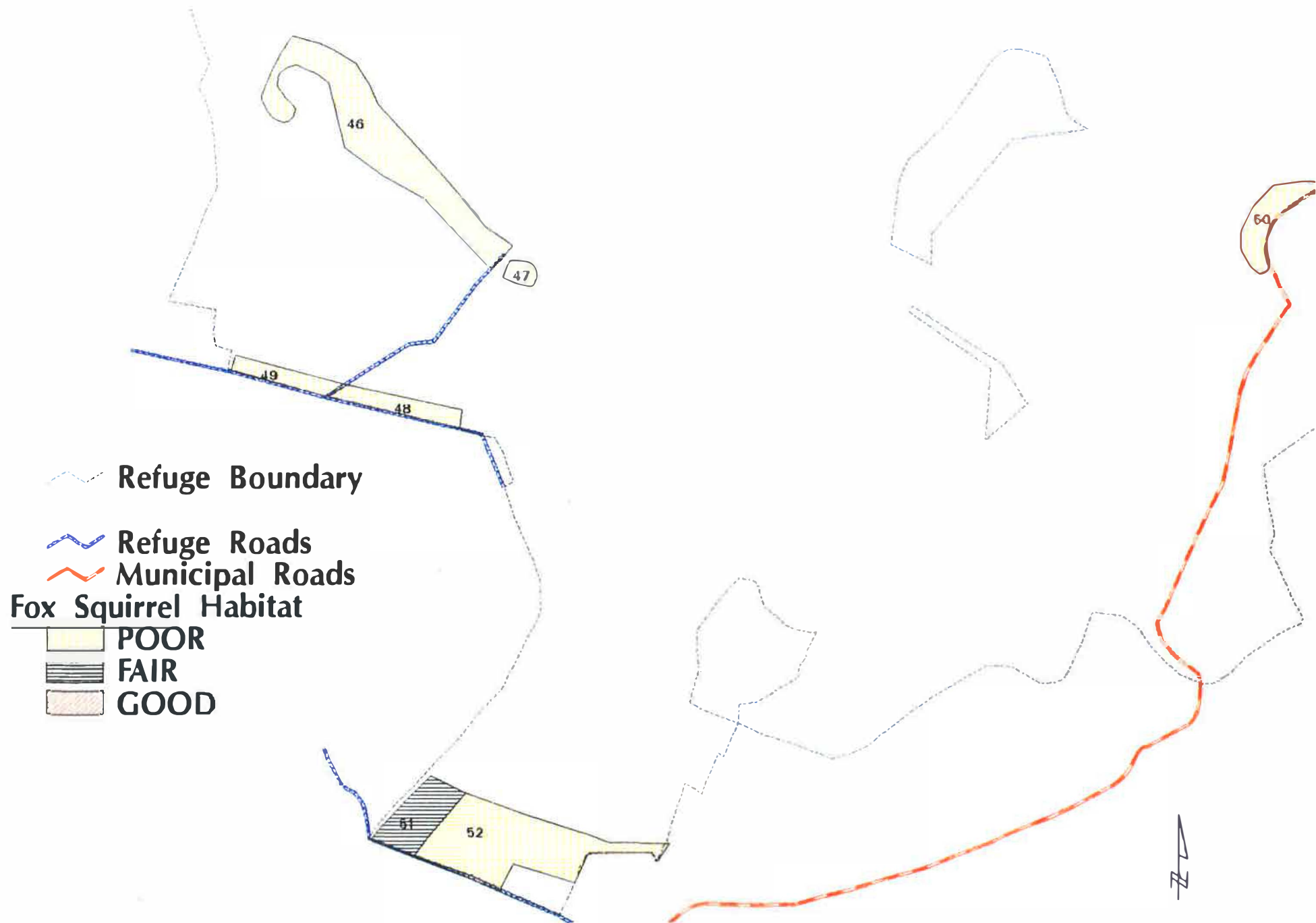
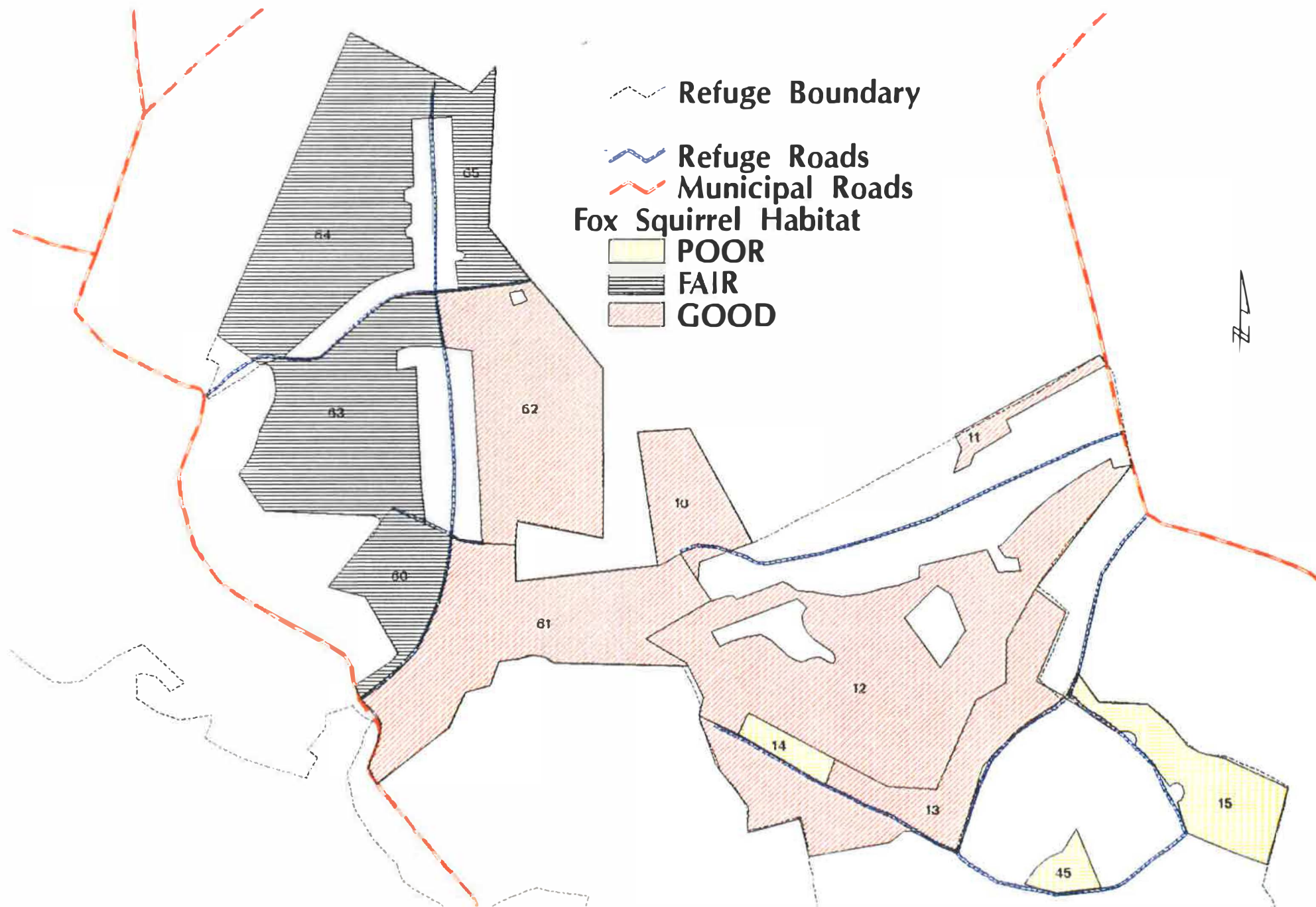


FIGURE 6D. Fox Squirrel Habitat at Blackwater National Wildlife Refuge.



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## APPENDIX A



<i>Stand 1</i>	Acres: 148	Average DBH: 14.4 inches
Basal Area: 127 square feet		Cover Type: Loblolly Pine-Hardwoods
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Moderate
Species Composition:	LP-58%, RM-11%, SG-10%, NRO-7%, WILLO-5%, WO-3%, SCO-3%, BG-1%, HOL-1%, SRO-1%	

Field Notes: This is a fairly open stand with some small, scattered areas of greenbrier and Japanese honeysuckle. Overall, the site is fairly dry, but there is some standing water in it's southern portion. Although this is a mature stand with numerous large trees (16" DBH and greater) very few den trees were observed. Red maple and sweetgum comprise most of the saplings in the stand.

<i>Stand 2</i>	Acres: 19	Average DBH: 15.8 inches
Basal Area: 140 sq. ft./acre		Cover Type: Loblolly Pine-Oak
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Moderate
Species Composition:	LP-63%, SG-16%, NRO-11%, WILLO-10%	

Field Notes: This is a fairly dry site with a thick understory that is comprised of grass, poison ivy, fern and Japanese honeysuckle. This mature stand has a number of large trees, but few den trees were observed. Loblolly pine comprises the vast majority of the overstory while northern red oak and willow oak comprise most of stand's saplings.

<i>Stand 3</i>	Acres: 53	Average DBH: 13.6 inches
Basal Area: 158 square feet/acre		Cover Type: Loblolly Pine-Oak
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Moderate
Species Composition:	LP-48%, RM-13%, BG-8%, SG-8%, WO-8%, WILLO-6%, SCO-5%, NRO-3%, SRO-1%	

Field Notes: This stand occupies a fairly dry site and has a very thick understory comprised mostly of sweet-pepper bush. This mature stand has numerous large trees, but few den trees were observed. Red maple and blackgum comprise most of the saplings in the stand.

<i>Stand 4</i>	Acres: 109	Average DBH: 13.8 inches
Basal Area: 125 square feet/acre		Cover Type: Loblolly Pine-Oak
Gypsy Moth Hazard Rating: High		SPB Hazard Rating: Low
Species Composition:	LP-23%, WO-17, NRO-14, RM-14%, SG-11%, SCO-8%, WILLO-7%, BG-4%, SRO-2%	

Field Notes: The northwestern portion of this stand is fairly open and is fairly dry. Scattered areas of sweet-pepper bush and greenbrier exist in the stand. There are also some scattered areas that are fairly wet. Numerous den trees were noticed in this mature stand. Red maple and sweetgum comprise most of the saplings in the stand.

<i>Stand 5</i>	Acres: 76	Average DBH: 8.0 inches
Basal Area: 90 square feet/acre		Cover Type: Loblolly Pine-Oak
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Very Low
Species Composition:	LP-48%, RM-21%, NRO-7%, SG-7%, WILLO-6%, WO-4%, BG-4% SCO-3%	

Field Notes: This is a young stand with very few large trees and very few den trees. Mast production is very limited at the present time. Some scattered wet areas exist throughout the stand. Red maple, sweetgum and blackgum comprise most of the stand's saplings.

<i>Stand 6</i>	Acres: 281	Average DBH: 10.7 inches
Basal Area: 112 square feet/acre		Cover Type: Loblolly Pine-Oak
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Low
Species Composition:	LP-31%, RM-17%, SG-10%, WO-9%, NRO-7%, BEE-7%, SCO-5%, BG-4%, SRO-4%, WILLO-4%, PO-1%, SASS-1%	

Field Notes: This moderately dry and open stand contains some scattered wet areas and some small patches of greenbrier, most of which is located west of the road that dissects the stand. Beech, which is both an important mast producer and denning tree, is fairly common. Red maple, sweetgum and blackgum comprise most of the stand's saplings.

<i>Stand 7</i>	Acres: 64	Average DBH: 12.3 inches
Basal Area: 114 square feet/acre		Cover Type: Loblolly Pine-Oak
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Very Low
Species Composition:	LP-29%, RM-23%, WO-15%, BG-9%, SCO-8%, WILLO-4%, NRO-4%, BEE-4%, SG-3%, ONC-1%	

Field Notes: A few wet areas exist in this mature stand which contains a fair amount of both greenbrier and sweet-pepper bush. Most of the loblolly pine is located in the southern portion. Several den trees were observed. Blackgum and red maple comprise most of the saplings in the stand.

<i>Stand 8</i>	Acres: 4	Average DBH: 12.0 inches
Basal Area: 163 square feet/acre		Cover Type: Loblolly Pine
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: High
Species Composition:	LP-80%, SG-12%, RM-6%, WO-2%	

Field Notes: This stand is on a fairly dry site with very little regeneration. No den trees were noticed in this dense stand. The overstory is comprised exclusively of loblolly pine.

<i>Stand 9</i>	Acres: 52	Average DBH: 14.5 inches
Basal Area: 152 square feet/acre		Cover Type: Loblolly Pine-Hardwoods
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Moderate
Species Composition:	LP-54%, RM-17%, NRO-7%, BG-7%, WO-4%, SG-4%, WILLO-2%, HOL-2%, ONC-2%, BEE-1%	

Field Notes: This dense stand is on a fairly dry site which has very little established regeneration. Several den trees were observed in this mature stand. Most of the holly is located in the western portion. Red maple makes up most of the stand's saplings.

<i>Stand 10</i>	Acres: 45	Average DBH: 14.1 inches
Basal Area: 100 square feet/acre		Cover Type: Mixed Hardwoods
Gypsy Moth Hazard Rating: High		SPB Hazard Rating: Very Low
Species Composition:	SG-20%, NRO-14%, RM-13%, SCO-11%, BEE-10%, WO-8%, SRO-7%, WILLO-7%, BG-7%, ONC-3%	

Field Notes: This is a moderately moist site with scattered areas of fairly dense, brushy understory. Beech is common in this mature stand. A few den trees were observed. Red maple and blackgum comprise most of the stand's saplings.

<i>Stand 11</i>	Acres: 16	Average DBH: 14.6 inches
Basal Area: 80 square feet/acre		Cover Type: Mixed Hardwoods
Gypsy Moth Hazard Rating: High		SPB Hazard Rating: Very Low
Species Composition:	WO-22%, RM-19%, WILLO-16%, SCO-13%, BEE-13%, NRO-9%, SG-8%	

Field Notes: Greenbrier comprises a lot of the stand's thick understory. Beech den trees are common in this mature stand. Some of the stand received a light partial cut a few years ago. The southwestern corner is comprised predominantly of small sweetgum. In general, this stand has high mast production potential.

<i>Stand 12</i>	Acres: 217	Average DBH: 12.5 inches
Basal Area: 101 square feet/acre		Cover Type: Mixed Hardwoods
Gypsy Moth Hazard Rating: High		SPB Hazard Rating: Very Low
Species Composition:	WO-24%, RM-21%, LP-16%, WILLO-8%, NRO-7%, SG-5%, SCO-5%, BG-4%, HOL-4%, ONC-2%, BEE-2%, SRO-2%	

Field Notes: A few den trees were observed in this relatively open stand. The northeastern corner of the stand is well drained and is where most of the white oaks are located. Willow oaks are common in the wet areas. A variety of species and diameters exists throughout the stand and it has good mast production potential. Red maple and sweetgum comprise most of the saplings.

<i>Stand 13</i>	Acres: 99	Average DBH: 13.3 inches
Basal Area: 137 square feet/acre		Cover Type: Loblolly Pine-Oak
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Moderate
Species Composition:	LP-50%, RM-12%, WILLO-10%, WO-8%, NRO-5%, SCO-4%, BG-4%, SG-3%, ONC-3%, SRO-1%	

Field Notes: This stand is on a fairly open and dry site. Most of the den trees in this mature stand were observed in the northern portion. The southern portion contains a larger percentage of the loblolly pine. Sweetgum, blackgum and red maple comprise most of the saplings in the understory.

<i>Stand 14</i>	Acres: 20	Average DBH: 5.2 inches
Basal Area: 146 square feet/acre		Cover Type: Loblolly Pine
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Moderate
Species Composition:	LP-80%, SG-14%, RM-5%, BG-1%	

Field Notes: This very dense young stand is located on a fairly dry site. No den trees were detected in this stand. The overstory is comprised exclusively of loblolly pine. Mast production is very limited at the present time.

<i>Stand 15</i>	Acres: 55	Average DBH: 12.3 inches
Basal Area: 144 square feet/acre		Cover Type: Loblolly Pine-Hardwoods
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Moderate
Species Composition:	LP-78%, SG-8%, HOL-5%, RM-4%, SCO-3%, BG-1%, ONC-1%	

Field Notes: This stand is on a very wet site and a fair amount of marsh grass occurs, especially along the southwestern edge. Very few den trees were noticed. Sweetgum and red maple comprise most of the stand's saplings.

<i>Stand 16</i>	Acres 8	Average DBH: 12.5 inches
Basal Area: 133 square feet/acre		Cover Type: Loblolly Pine
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Moderate
Species Composition:	LP-80%, WILLO-7%, NRO-5%, BG-3%, SG-3%, ONC-2%	

Field Notes: This is a fairly open stand growing on a relatively dry site. Some small grassy areas are scattered throughout the area. Very few den trees were noticed in this mature stand. Blackgum and sweetgum comprise most of the saplings in the understory.

<i>Stand 17</i>	Acres: 53	Average DBH: 6.3
Basal Area: 110 square feet/acre		Cover Type: Loblolly Pine
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Moderate
Species Composition:	LP-91%, HOL-3%, NRO-2%, WILLO-2%, SCO-2%	

Field Notes: The southern portion of the stand is very wet and has a grassy understory. The northern portion is a little drier. No den trees were detected in this immature stand. Mast production potential is very limited.

<i>Stand 18</i>	Acres: 55	Average DBH: 9.3 inches
Basal Area: 107 square feet/acre		Cover Type: Loblolly Pine-Hardwoods
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Moderate
Species Composition:	LP-72%, SG-5%, RM-5%, SCO-5%, ONC-3%, NRO-3%, WILLO-3%, WO-2%, WA-1%, BG-1%	

Field Notes: This stand is relatively open and is located on a fairly wet site. This immature stands contains very few large trees and consequently few den trees were noticed. Red maple and sweetgum comprise most of the saplings in the stand.

<i>Stand 19</i>	Acres: 83	Average DBH: 10.9 inches
Basal Area: 144 square feet/acre		Cover Type: Loblolly Pine-Hardwoods
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Moderate
Species Composition:	LP-78%, SG-10%, BG-6%, RM-3%, SCO-3%	

Field Notes: This is a relatively young stand growing on a fairly wet site. Very little understory exists. Few large trees and very few den trees were encountered. Sweetgum, red maple and blackgum comprise most of the stand's saplings.

<i>Stand 20</i>	Acres: 19	Average DBH: 8.9 inches
Basal Area: 153 square feet/acre		Cover Type: Loblolly Pine-Hardwoods
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Moderate
Species Composition:	LP-70%, SG-17%, HOL-7%, SCO-4%, WO-2%	

Field Notes: This young stand is growing on a wet site and has an open understory. Very few den or large trees were noticed. Sweetgum and holly comprise most of the saplings in this stand.



<i>Stand 21</i>	Acres: 27	Average DBH: 11.9 inches
Basal Area: 93 square feet/acre		Cover Type: Loblolly Pine-Oak
Gypsy Moth Hazard Rating: High		SPB Hazard Rating: Very Low
Species Composition:	LP-41%, WO-19%, SG-16%, SCO-8%, WO-5%, BG-3%, PO-3%, SRO-3%, NRO-2%	

Field Notes: This stand is on a relatively dry site and has a fairly open understory. Very few den trees were observed. A mixture of hardwood tree species comprises the stand's saplings.

<i>Stand 22</i>	Acres: 20	Average DBH: 9.4 inches
Basal Area: 83 square feet/acre		Cover Type: Loblolly Pine
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Moderate
Species Composition:	LP-91%, SG-6%, SCO-3%	

Field Notes: This stand is on a very wet site and has a grassy understory. Very few large trees or den trees were observed in this immature stand. Potential mast production is very limited.

<i>Stand 23</i>	Acres: 9	Average DBH: 10.5 inches
Basal Area: 125 square feet/acre		Cover Type: Loblolly Pine-Oak
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Low
Species Composition:	LP-52%, NRO-16%, SCO-12%, BG-8%, SG-4%, RM-4%, ONC-4%	

Field Notes: This stand has an open understory and is located on a fairly dry site. Very few large or den trees were noticed. Most of the saplings in the stand are blackgum.

<i>Stand 24</i>	Acres: 47	Average DBH: 9.1 inches
Basal Area: 160 square feet/acre		Cover Type: Loblolly Pine
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: High
Species Composition:	LP-81%, SG-8%, RM-5%, SCO-3%, WILLO-2%, BG-1%	

Field Notes: This immature stand is on a wet site with lots of greenbrier. A higher concentration of loblolly pine is located in the northern end of the stand and is wetter than the southern end. Very few large trees or den trees were observed. Sweetgum and red maple comprise most of the stand's saplings.

<i>Stand 25</i>	Acres: 20	Average DBH: 12.6 inches
Basal Area: 150 square feet/acre		Cover Type: Loblolly Pine
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: High
Species Composition:	LP-85%, SG-8%, NRO-5%, WA-1%, ONC-1%	

Field Notes: This stand is growing on a fairly dry site and has little understory vegetation other than some scattered grassy areas. Very few large trees and very few den trees were detected. Most of the saplings in the stand are sweetgum.

<i>Stand 26</i>	Acres: 44	Average DBH: 10.7 inches
Basal Area: 173 square feet/acre		Cover Type: Loblolly Pine-Hardwoods
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: High
Species Composition:	LP-73%, NRO-12, RM-10%, WO-4%, ONC-1%	

Field Notes: The understory in this stand is open and the site is fairly dry. Most of the larger trees are loblolly pine. Very few den trees were detected. Red maple, blackgum and northern red oak comprise most of the saplings in this stand.

<i>Stand 27</i>	Acres: 40	Average DBH: 12.3 inches
Basal Area: 94 square feet/acre		Cover Type: Mixed Hardwoods
Gypsy Moth Hazard Rating: High		SPB Hazard Rating: Very Low
Species Composition:	SG-23%, SCO-18%, LP-17%, WILLO-17%, RM-14%, NRO-5%, BG-3%, WO-1%, PO-1%, ONC-1%	

Field Notes: This stand is on somewhat of a wet site, especially in the eastern portion of the stand. Greenbrier is very common and several large den trees were noted. Sweetgum and willow oak comprise most of the stand's saplings.

<i>Stand 28</i>	Acres: 32	Average DBH: 9.4 inches
Basal Area: 114 square feet/acre		Cover Type: Loblolly Pine-Hardwoods
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Moderate
Species Composition:	LP-77%, BG-5%, SG-5%, RM-4%, WO-2%, SCO-2%, NRO-2%, HOL-2%, ONC-1%	

Field Notes: This stand has a fairly open understory and is on a dry site except for some areas along the southern and eastern boundaries. Very few large or den trees were noticed in this immature stand. Blackgum, sweetgum and red maple comprise most of the saplings in the stand.

<i>Stand 29</i>	Acres: 112	Average DBH: 10.5 inches
Basal Area: 128 square feet/acre		Cover Type: Loblolly Pine-Oak
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Low
Species Composition:	LP-46%, RM-13%, SG-10%, WO-8%, WILLO-7%, NRO-6%, BG-4%, SCO-3%, SRO-1%, PO-1%, ONC-1%	

Field Notes: For the most part, this stand is on a dry site and has an open understory. However, there are some scattered wet areas in the western portion and also some scattered small patches of greenbrier throughout the stand. A few large trees and a few den trees were noticed in this immature stand. A mixture of several hardwood species comprise the saplings in this stand.

<i>Stand 30</i>	Acres: 49	Average DBH: 7.5 inches
Basal Area: 117 square feet/acre		Cover Type: Loblolly Pine
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Moderate
Species Composition:	LP-89%, SG-6%, NRO-2%, BG-2%, WILLO-1%	

Field Notes: This stand is on a very wet site with an abundance of tall marsh grass. No den trees and very few large trees were detected in this immature stand. Sweetgum and blackgum comprise most of the stand's saplings. Potential mast production is limited.

<i>Stand 31</i>	Acres: 34	Average DBH: 7.5
Basal Area: 172 square feet/acre		Cover Type: Loblolly Pine
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Very High
Species Composition:	LP-81%, NRO-9%, BG-4%, SG-3%, ONC-3%	

Field Notes: The understory in this stand is open and is located on a fairly dry site except along the Blackwater River. This immature stand has very few large trees or den trees. Potential mast production is limited.

<i>Stand 32</i>	Acres: 17	Average DBH: 9.2 inches
Basal Area: 130 square feet/acre		Cover Type: Loblolly Pine-Oak
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Moderate
Species Composition:	LP-64%, SG-13%, NRO-10%, SCO-10%, WILLO-3%	

Field Notes: This immature stand is on a fairly dry site and has a fairly open understory. Some wet areas do exist in the portion that border the Blackwater River. The largest percentage of oak occurs in the northwestern portion. Very few mature trees or den trees were observed in this stand.

<i>Stand 33</i>	Acres: 42	Average DBH: 11.1 inches
Basal Area: 142 square feet/acre		Cover Type: Loblolly Pine-Hardwoods
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Moderate
Species Composition:	LP-67%, SG-8%, RM-7%, WO-7%, NRO-5%, WILLO-3%, ONC-2%, HOL-1%	

Field Notes: The stand has a fairly open understory and is located on a fairly dry site with some scattered wet areas. Very few den trees were observed. Red maple, sweetgum and blackgum comprise most of the stand's saplings.

<i>Stand 34</i>	Acres: 29	Average DBH: 9.7 inches
Basal Area: 157 square feet/acre		Cover Type: Loblolly Pine-Hardwoods
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: High
Species Composition:	LP-68%, SG-17%, RM-6%, WILLO-5%, BG-2%, SCO-2%	

Field Notes: This stand is on a wet site and has an open understory. Very few large trees and only a few den trees were detected. Red maple and sweetgum comprise most of the stand's saplings.

<i>Stand 35</i>	Acres: 123	Average DBH: 10.7
Basal Area: 163 square feet/acre		Cover Type: Loblolly Pine-Hardwoods
Gypsy Moth Hazard Rating: Moderate		SPB Rating: Moderate
Species Composition:	LP-58%, RM-13%, SG-10%, WILLO-5%, NRO-5%, SCO-4%, BG-2%, WO-2%, PO-1%	

Field Notes: This stand is on a fairly dry site except for the middle of the stand where some wet areas occur. It is fairly open but a few patches of greenbrier in the wet areas. There are few den trees in the stand. Sweetgum, red maple and blackgum comprise most of the saplings in the stand.

<i>Stand 36</i>	Acres: 98	Average DBH: 9.9
Basal Area: 159 square feet/acre		Cover Type: Loblolly Pine-Hardwoods
Gypsy Moth Hazard Rating: Low		SPB Rating: High
Species Composition:	LP-78%, SG-9%, BG-4%, RM-4%, SCO-3%, NRO-2%	

Field Notes: The western edge and the central portion of this stand are wet. The understory is fairly open. Very few large trees or den trees were noticed in the immature stand. Sweetgum, blackgum, red maple and red oak comprise most of the saplings in the stand.

<i>Stand 37</i>	Acres: 69	Average DBH: 11.3 inches
Basal Area: 127 square feet/acre		Cover Type: Loblolly Pine-Oak
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Moderate
Species Composition:	LP-57%, SG-11%, WO-9%, BG-5%, SCO-5%, NRO-5%, RM-4%, WILLO-2%, ONC-2%	

Field Notes: Scattered wet areas occur throughout this stand. The understory is fairly open and the larger trees are primarily loblolly pine. Very few den trees were observed. Sweetgum and blackgum comprise most of the stand's saplings.

<i>Stand 38</i>	Acres: 40	Average DBH: 9.6 inches
Basal Area: 110 square feet/acre		Cover Type: Loblolly Pine-Hardwoods
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Low
Species Composition:	LP-49%, SG-27%, SCO-9%, RM-8%, WILLO-7%	

Field Notes: This stand is on a very wet site and has scattered areas of greenbrier. Standing water is common. The larger trees in the stand are loblolly pine. Very few den trees were detected. Sweetgum and red maple comprise most of the saplings in the stand.

<i>Stand 39</i>	Acres: 29	Average DBH: 10.7 inches
Basal Area: 100 square feet/acre		Cover Type: Mixed Hardwoods
Gypsy Moth Hazard Rating: High		SPB Hazard Rating: Very Low
Species Composition:	SG-57%, RM-20%, WILLO-10%, PO-7%, SCO-3%, LP-3%	

Field Notes: This stand is on a very wet site that has an open understory. Standing water and den trees (snags) are common. Sweetgum and red maple comprise most of the stand's saplings.

<i>Stand 40</i>	Acres: 17	Average DBH: 13.0 inches
Basal Area: 130 square feet/acre		Cover Type: Loblolly Pine-Oak
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Low
Species Composition:	LP-33%, SCO-18%, SG-13%, NRO-13%, RM-10%, BG-8%, WILLO-3%, WO-2%	

Field Notes: This stand has a fairly open understory in dry areas while wet areas contain a large amount of greenbrier. Numerous large trees and a few den trees were observed in this stand. The loblolly pine was concentrated in the northern portion.



<i>Stand 41</i>	Acres: 49	Average DBH: 9.7 inches
Basal Area: 131 square feet/acre		Cover Type: Loblolly Pine-Oak
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Moderate
Species Composition:	LP-70%, NRO-8%, WILLO-7%, SG-4%, WO-3%, RM-3%, BG-2%, SCO-1%, HOL-1%, PO-1%	

Field Notes: This stand has a fairly open understory and some of the wetter areas are grassy. The eastern portion of the stand is wetter than the western portion and the southwestern corner has the highest concentration of oaks. Very few den trees were detected.

<i>Stand 42</i>	Acres: 16	Average DBH: 8.0 inches
Basal Area: 180 square feet/acre		Cover Type: Loblolly Pine
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Very High
Species Composition:	LP-96%, SCO-2%, SG-2%	

Field Notes: This immature stand is on a very wet site with a high marsh grass understory. No large trees or den trees were detected in this stand.

<i>Stand 43</i>	Acres: 96	Average DBH: 11.3 inches
Basal Area: 141 square feet/acre		Cover Type: Loblolly Pine-Hardwoods
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: High
Species Composition:	LP-79%, SG-8%, SCO-5%, WILLO-3%, HOL-3%, WO-1%, NRO-1%	

Field Notes: This stand is on a fairly dry site and has a fairly open understory. A few large trees and a few den trees were detected. Most of the saplings are either sweetgum or holly.

<i>Stand 44</i>	Acres: 7	Average DBH: 12.7 inches
Basal Area: 115 square feet/acre		Cover Type: Loblolly Pine-Oak
Gypsy Moth Hazard Rating: High		SPB Hazard Rating: Low
Species Composition:	LP-48%, SCO-22%, SG-13%, SRO-9%, NRO-4%, WILLO-4%	

Field Notes: Both wet and dry areas occur in this stand and it has a fairly open understory. Numerous large trees but few den trees were encountered in this mature stand. Most of the saplings in the stand are sweetgum.

<i>Stand 45</i>	Acres: 13	Average DBH: 8.8 inches
Basal Area: 123 square feet/acre		Cover Type: Loblolly Pine
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Moderate
Species Composition:	LP-89%, SG-8%, WILLO-3%	

Field Notes: No large trees or den trees were observed in this immature stand. There is some high marsh grass in the eastern portion. Evidence of a recent fire was observed in this stand which killed some of the trees.

<i>Stand 46</i>	Acres: 67	Average DBH: 8.0 inches
Basal Area: 138 square feet/acre		Cover Type: Loblolly Pine
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Moderate
Species Composition:	LP-82%, HOL-6%, SG-5%, NRO-4%, WILLO-2%, SCO-1%	

Field Notes: This stand is on a fairly dry site with a fairly open understory. No large trees and very few den trees were noted. Most of the stand's saplings are holly.

<i>Stand 47</i>	Acres: 6	Average DBH: 5.8 inches
Basal Area: 120 square feet/acre		Cover Type: Loblolly Pine
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Moderate
Species Composition:	LP-96%, SG-4%	

Field Notes: This immature stand is on a fairly dry site with somewhat of an open understory. No large trees or den trees were observed. This stand is very uniform with most of the trees measuring in the 6" dbh range. Potential mast production is very limited.

<i>Stand 48</i>	Acres: 12	Average DBH: 7.1 inches
Basal Area: 133 square feet/acre		Cover Type: Loblolly Pine
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Moderate
Species Composition:	LP-92%, SG-4%, HOL-2%, RM-2%	

Field Notes: This young stand is on a wet site and has a high marsh grass understory. No large trees or den trees were detected. Sweetgum, holly and red maple compose most of the saplings in this stand. Potential mast production is very limited.

<i>Stand 49</i>	Acres: 10	Average DBH: 7.2 inches
Basal Area: 120 square feet/acre		Cover Type: Loblolly Pine
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Moderate
Species Composition:	LP-88%, SG-4%, WILLO-4%, PO-4%	

Field Notes: This stand is on a wet site and has a high marsh grass understory. Very few large trees or den trees were detected. Mast production is very limited at the present time.

<i>Stand 50</i>	Acres: 17	Average DBH: 11.3 inches
Basal Area: 157 square feet/acre		Cover Type: Loblolly Pine
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Very High
Species Composition:	LP-98%, RM-2%	

Field Notes: This stand is on a fairly dry site with an abundance of poison ivy and greenbrier in the understory. No den trees were detected. Essentially, loblolly pine makes up the entire overstory.

<i>Stand 51</i>	Acres: 22	Average DBH: 9.0 inches
Basal Area: 104 square feet/acre		Cover Type: Loblolly Pine-Oak
Gypsy Moth Hazard Rating: High		SPB Hazard Rating: Very Low
Species Composition:	LP-30%, SG-13%, WILLO-12%, WO-10%, NRO-10%, BEE-6%, RM-6%, SCO-6%, BG-5%, SRO-2%	

Field Notes: The stand is fairly wet in the northern section but drier in the southern portion, where the largest concentration of loblolly pine is located. A few large trees and a few den trees were observed. Red maple and blackgum comprise most of the stand's saplings. Potential mast production is good.

<i>Stand 52</i>	Acres: 63	Average DBH: 5.8 inches
Basal Area: 136 square feet/acre		Cover Type: Loblolly Pine-Hardwoods
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Moderate
Species Composition:	LP-71%, SG-13%, RM-7%, WILLO-5%, BG-2%, NRO-2%	

Field Notes: This is a very dense and immature stand, and about half the site is wet. No large trees or den trees were detected. The vast majority of the trees have a dbh from 4 to 8 inches.

<i>Stand 53</i>	Acres: 4	Average DBH: 10.7 inches
Basal Area: 190 square feet/acre		Cover Type: Loblolly Pine
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Very High
Species Composition:	LP-87%, SG-10%, RO-3%	

Field Notes: This dense stand is on a fairly dry site and has mostly loblolly pine in the overstory. No den trees were noticed and mast production is very limited.

<i>Stand 54</i>	Acres: 6	Average DBH: 12.2 inches
Basal Area: 145 square feet/acre		Cover Type: Loblolly Pine
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: High
Species Composition:	LP-83%, NRO-11%, SCO-3%, WILLO-3%	

Field Notes: Loblolly pine comprises most of the overstory in this small, isolated stand. There are both wet and dry areas throughout this stand. No den trees were detected.

<i>Stand 55</i>	Acres: 7	Average DBH: 8.6 inches
Basal Area: 135 square feet/acre		Cover Type: Loblolly Pine-Hardwoods
Gypsy Moth Hazard Rating: Low		SPB Hazard Rating: Moderate
Species Composition:	LP-78%, SG-19%, RM-3%	

Field Notes: No den trees were observed in this isolated stand. Most of the larger trees are loblolly pine. Potential mast production is limited.

<i>Stand 56</i>	Acres: 45	Average DBH: 10.9
Basal Area: 129 square feet/acre		Cover Type: Loblolly Pine-Oak
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: High
Species Composition:	LP-36%, RM-16%, SG-13%, WILLO-13%, WO-9%, BG-6%, SRO-3%, PO-2%, NRO-2%	

Field Notes: This stand is located on a fairly dry site and some scattered areas of sweet-pepper bush and greenbrier were noted. Sweetgum and red maple comprise most of the stand's saplings and a few den trees were observed. Potential mast production is fair.

<i>Stand 57</i>	Acres: 16	Average DBH: 8.8
Basal Area: 90 square feet/acre		Cover Type: Mixed Hardwood
Gypsy Moth Hazard Rating: High		SPB Hazard Rating: Very Low
Species Composition:	WILLO-24%, WO-20%, RM-16%, BG-16%, SRO-9%, SG-7%, SCO-6%, LP-2%	

Field Notes: This is a fairly dry site with a thick understory that is comprised mainly of greenbrier. While the potential for mast product is good, very few den trees were detected in this immature stand. Most of the willow oak is located in the northern portion of the stand. A mixture of hardwood tree species comprises the stand's saplings.

<i>Stand 58</i>	Acres: 69	Average DBH: 11.4
Basal Area: 129 square feet/acre		Cover Type: Loblolly Pine-Oak
Gypsy Moth Hazard Rating: High		SPB Hazard Rating: Low
Species Composition:	LP-32%, SG-24%, NRO-12%, RM-11%, WILLO-11%, BG-4%, SRO-3%, WO-2%, ONC-1%	

The northern portion is fairly dry with an understory of greenbrier while the southern portion is fairly open with some wet areas. Very few den trees were detected in the stand. Sweetgum, blackgum and red maple comprise most of the saplings in the stand.

<i>Stand 59</i>	Acres: 52	Average DBH: 9.3
Basal Area: 146 square feet/acre		Cover Type: Loblolly Pine
Gypsy Moth hazard Rating: Low		SPB Hazard Rating: High
Species Composition:	LP-82%, SG-11%, NRO-2%, WILLO-2%, BG-1%, SRO-1%, ONC-1%	

Field Notes: Several wet areas exist in this immature stand that is dominated by loblolly pine. Very few den trees were detected and potential mast production is limited. Loblolly pine and sweetgum comprise most of the stand's saplings.

<i>Stand 60</i>	Acres: 53	Average DBH: 10.3
Basal Area: 88 square feet/acre		Cover Type: Mixed Hardwoods
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Very Low
Species Composition:	RM-17%, SG-17%, LP-17%, BG-15%, WILLO-10%, SRO-7%, HOL-5%, SCO-5%, WO-3%, BEE-3%, SRO-1%	

Field Notes: A large amount of greenbrier exists in the dense understory of this stand. Very few den trees were detected. Sweetgum and blackgum comprise most of the saplings in the stand.



<i>Stand 61</i>	Acres: 147	Average DBH: 12.1
Basal Area: 93 square feet/acre		Cover Type: Mixed Hardwood
Gypsy Moth Hazard Rating: High		SPB Hazard Rating: Very Low
Species Composition:	SG-20%, SCO-14%, LP-13%, WO-11%, RM-11%, WILLO-10%, SRO-10%, BG-6%, HOL-4%, BEE-1%	

Field Notes: Greenbrier is abundant in this stand and very few den trees were detected. Potential mast production is good in this stand. Red maple and holly comprise most of the stand's saplings.

<i>Stand 62</i>	Acres: 149	Average DBH: 12.1
Basal Area: 76 square feet/acre		Cover Type: Mixed Hardwood
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Very Low
Species Composition:	BEE-24%, RM-18%, SCO-17%, SRO-14%, BG-7%, WO-6%, SG-6%, LP-4%, HOL-3%, WILLO-1%	

Field Notes: Several wet areas occur throughout the stand. Greenbrier and sweet-pepper bush form a dense understory. Beech and den trees are common in this mature stand. Holly and blackgum make up most of the saplings and the potential mast production is very good.

<i>Stand 63</i>	Acres: 126	Average DBH: 11.4
Basal Area: 93 square feet/acre		Cover Type: Mixed Hardwood
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Very Low
Species Composition:	RM-24%, BEE-14%, WO-13%, LP-11%, SRO-10%, WILLO-9%, SCO-6%, BG-6%, SG-4%, HOL-2%, ONC-1%	

Field Notes: The understory on this fairly dry site is comprised of greenbrier and lots of sweet-pepper bush, some of which are 6-7 feet tall. Some wet areas do exist in this stand. Potential mast production is good and den trees are very numerous. Blackgum and red maple comprise most of the stand's saplings.

<i>Stand 64</i>	Acres: 153	Average DBH: 11.7
Basal Area: 93 square feet/acre		Cover Type: Mixed Hardwood
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Very Low
Species Composition:	RM-30%, WO-18%, SG-16%, SCO-10%, BG-7%, BEE-7%, SRO-4%, WILLO-3%, NRO-2%, LP-2%, ONC-1%	

Field Notes: The dense understory in the stand is predominately sweet-pepper bush with some greenbrier and rubus. Den trees are numerous and potential mast production is good. Scattered wet areas occur in the stand. Red maple and sweetgum comprise most of the saplings in the stand.

<i>Stand 65</i>	Acres: 47	Average DBH: 11.6
Basal Area: 99 square feet/acre		Cover Type: Mixed Hardwood
Gypsy Moth Hazard Rating: Moderate		SPB Hazard Rating: Very Low
Species Composition:	RM-31%, BEE-21%, WILLO-12%, SG-10%, WO-7%, BG-6%, SRO-5%, LP-3%, ONC-3%, SCO-2%	

Field Notes: Sweet-pepper bush comprises most of the dense understory in the stand. Den trees are numerous and this stand has good mast production potential. Red maple, sweetgum and holly make up the majority of the stand's saplings.